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May 28, 1992

APPROVAL FOR RELEASE

Unnumbered 2-page ltr dtd 5/28/92, ME Mitchell
Document: # to PJ Gross (DOE-OR), ^{Date} , ORR RADIONUCLIDE
Title/Subject NESHAP ANNUAL AIR EMISSIONS REPORT;
and 2 enclosures (72 pages)

Approval for unrestricted release of this document is authorized by the Oak Ridge K-25 Site Classification and Information Control Office, Martin Marietta Energy Systems, Inc., PO Box 2003, Oak Ridge, TN 37831-7307.

Kevin S. Smith
K-25 Classification & Information Control Officer

5/28/92
Date

Mr. P. J. Gross, Director
Environmental Protection Division
DOE Oak Ridge Field Office
Post Office Box 2001
Oak Ridge, Tennessee 37831-8738

Dear Mr. Gross:

Oak Ridge Reservation (ORR) Radionuclide National Emission Standards for Hazardous Air Pollutants (NESHAP) Annual Air Emissions Report

As requested in your March 31, 1992, letter to me, please find enclosed the 1991 ORR Annual Air Emissions report as required by 40 CFR 61.94. Two slightly different versions of the Annual Report are enclosed. Enclosure 1 is to be submitted to Region IV of the Environmental Protection Agency (EPA). Enclosure 2 is to be submitted to DOE Headquarters because it contains additional and supplemental information requested by DOE Headquarters but not required by EPA.

A minor addition may be made to the report within the next week as Oak Ridge National Laboratory (ORNL) completes its site-wide air emissions inventory as required by the Federal Facility Compliance Agreement. If necessary, ORNL may add one or two additional grouped sources as the air emissions inventory is completed. This modification is easily made and will not affect the compliance status or dose assessment for the ORR. Once these changes and additions are obtained, your office will be provided with a copy of the applicable pages.

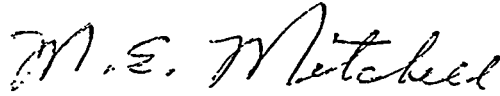
Annual Reports for the Paducah and Portsmouth reservations will be submitted by the installation to their respective DOE site offices under a separate cover letter.

165#

May 28, 1992

If you have any questions or need additional information, please contact R. H. Kingrea at 6-6210.

Sincerely,



M. E. Mitchell, Director
Environmental Compliance

MEM:RHKingrea:jc

- Enclosure 1: ORR 1991 NESHAP Annual Air Emissions Report for Submittal to EPA-IV
Enclosure 2: ORR 1991 NESHAP Annual Air Emissions Report for Submittal to DOE-HQ

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Enclosure 1: ORR 1991 NESHAP Annual Air Emissions Report for Submittal to EPA-IV

**U. S. Department of Energy
Air Emissions Annual Report (ES/ESH-24)
(under Subpart H, 40 CFR 61.94)
Calendar Year 1991**

Site Name: Oak Ridge Reservation

Field Office Information

Office: DOE OAK RIDGE FIELD OFFICE

Address: P.O. Box 2001

Oak Ridge, Tennessee 37831-8738

Contact: Peter J. Gross Phone: 615-576-0948

Site Information

Operating Contractor: Martin Marietta Energy Systems, Inc.

Address: P.O. Box 2003

Oak Ridge, Tennessee 37831-0738

Contact : Michael E. Mitchell Phone: 615-576-8006

SECTION I. FACILITY INFORMATION

SITE DESCRIPTION: ORR

The Oak Ridge Reservation (ORR) is located within the corporate limits of the city of Oak Ridge in eastern Tennessee. The ORR consists of approximately 14,300 ha (35,300 acres) of federally owned lands. The ORR site is predominantly to the west and south of the city of Oak Ridge, which has a population of 28,000. Oak Ridge lies in a valley between the Cumberland and southern Appalachian mountain ranges and is bordered on one side by the Clinch River. The Cumberlands are about 16 km (10 miles) northwest; 113 km (70 miles) to the southeast are the Great Smoky Mountains. A map of the ORR is found at the end of this report.

Except for the city of Oak Ridge, the land within 8 km (5 miles) of the ORR is predominantly rural, used largely for residences, small farms, and cattle pasture. Fishing, boating, water skiing, and swimming are favorite recreational activities in the area. The approximate location and population of the towns nearest the ORR are Oliver Springs (pop. 3600), 11 km (6.8 miles) to the northwest; Clinton (pop. 5200), 16 km (10 miles) to the northeast; Lenoir City (pop. 5400), 11 km (6.8 miles) to the southwest; and Harriman (pop. 8300), 13 km (8 miles) to the west. Knoxville, the major metropolitan area nearest Oak Ridge, is located about 40 km (25 miles) to the east and has a population of approximately 183,000.

Oak Ridge has a temperate climate with warm, humid summers and cool winters. Spring and fall are usually long, and the weather is normally sunny with mild temperatures. Severe storms such as tornadoes or high-velocity winds are rare. The mountains frequently divert hot, southeasterly winds that develop along the southern Atlantic coast. Oak Ridge is one of the country's calmest wind areas. The atmosphere can be considered to be in an inversion status about 36% of the time. The daily up-and-down valley winds, however, provide some diurnal exchange. The prevailing wind directions are northeasterly (up-valley) and southwesterly (down-valley).

The ORR contains three major operating facilities: Oak Ridge Y-12 Plant (Y-12 Plant), Oak Ridge National Laboratory (ORNL), and Oak Ridge K-25 Site (K-25 Site). In addition to operations at these three installations, DOE is responsible for facilities at the Oak Ridge Associated Universities (ORAU) that handle extremely small quantities of radionuclides for research and training purposes. Annual possession quantities for radionuclides handled at ORAU are well below the annual possession quantities for environmental compliance listed in 40 CFR 61, Appendix E, Table 1. Therefore, emission estimates from the ORAU operations are not included in this report.

The ORR and Environmental Protection Agency (EPA) Region IV have negotiated a Federal Facilities Compliance Agreement (FFCA), which will be used to bring the ORR into full compliance with 40 CFR 61, Subpart H. As required by the FFCA, the *Compliance Plan: National Emission Standards for Hazardous Air Pollutants for Airborne Radionuclides on the Oak Ridge Reservation, Oak Ridge, Tennessee*, was submitted to EPA Region IV on December 27, 1991. This compliance plan outlines in detail ORR's plan for complying with 40 CFR 61, Subpart H.

SOURCE DESCRIPTION: Y-12 PLANT

The Y-12 Plant is immediately adjacent to the city of Oak Ridge. Although the mission of the Y-12 Plant is currently in a state of flux, in 1991 the Y-12 Plant had five major responsibilities: (1) to fabricate nuclear weapons components; (2) to process source and special nuclear materials; (3) to provide support to the weapons design laboratories; (4) to provide support to other Martin Marietta Energy Systems, Inc., installations; and (5) to provide support to other government agencies. Activities associated with these functions include production of lithium compounds, recovery of enriched uranium from scrap material, and fabrication of uranium and other materials into finished parts and assemblies. Fabrication operations include vacuum casting, arc melting, powder compaction, rolling, forming, heat treating, machining, inspection, and testing. ORNL also operates research facilities at the Y-12 Plant. The ORNL facilities that emit radionuclides include the Biology Division laboratories, Fusion Energy Division facility, and Analytical Chemistry Division Laboratory.

Emissions of uranium from the Y-12 Plant occur as particulate emissions. Continuous sampling systems were used to monitor emissions from 81 process exhaust stacks. The sampling systems on all Y-12 stacks are similar in design to the stack samplers on the Uranium Chip Oxidization Facility, the Uranium Oxide Storage Vault, and the Enriched Uranium Conversion Facility. EPA Region IV reviewed the design and operation of the sampling systems on these three facilities as a part of the new source approval process. Approval to operate these facilities was received in April 1988. The stack sampling systems on the 81 monitored stacks were installed during an upgrade of the emissions monitoring system, which was completed in February 1987.

Of the 81 monitored stacks, 63 have been designated as major potential release points requiring continuous sampling under the NESHAP regulations. The source term information from the Y-12 Plant is obtained primarily from the operation of these continuous stack sampling systems located on enriched and depleted uranium exhaust stacks operated in 1991. The stacks that were continuously sampled included all but two of the process exhausts judged to have the potential to emit an environmentally significant quantity of uranium. The potential to emit was judged on the basis of a review of the operations and processes served by the exhaust systems to determine the quantity of uranium handled in the operation or process, the physical form of the uranium, and the nature of the operation or process. These factors determine the potential for uranium to become airborne in a manner that emissions to the environment might result. Sixty-three of the stacks which are currently equipped with continuous samplers have the potential to emit radionuclides that could cause a member of the public to receive an effective dose equivalent (EDE) equal to or greater than 0.1 mrem/year if no credit is taken for abatement equipment.

In addition to the 63 monitored stacks identified as major emission points, process stacks 112 and 115 are also major potential emission points. Both of these stacks are presently sampled by impinger-type samplers, which do not meet the requirements of 40 CFR 61.93(b). Continuous samplers were not installed when the other stacks were upgraded because of the corrosive conditions in the stacks. An action plan to upgrade both stacks has been developed and submitted to EPA as required under the FFCA. These two stack sampling systems will be upgraded by December 15, 1992.

The total of 65 major emission stacks in the 1991 annual report is significantly higher than the 18 identified in the 1990 annual report. The number of emission points subject to the requirements has increased over the past year for several reasons. First, increased conservatism in computer dose modeling (i.e., changes in solubility class assumptions) has resulted in a higher value of the dose-to-source term ratio. In addition, use of manufacturer's estimated abatement efficiencies instead of efficiencies provided in 40 CFR 61, Appendix D, have resulted in higher calculated potential doses.

While the majority of uranium emissions are monitored using the methods described above, it is recognized that some unmonitored emissions occur. These emissions result from room ventilation systems and unmonitored process stacks. The Y-12 Plant source term includes an estimate for both types of unmonitored emissions. The estimate of emissions from room ventilation systems is made using health physics data on airborne radioactivity concentrations in the work areas. Exhausts from any area where monthly concentration averages that exceeded 10% of the Derived Air Concentration (DAC) as defined in the *Compliance Plan* were included in the annual source term. The annual average concentrations were used with the design ventilation rates to arrive at the annual emission estimate for these areas. There were 24 ventilation systems from the enriched buildings and 4 ventilation systems from the depleted buildings that exceeded 10% of the DAC.

Additional unmonitored emissions occur from minor process stacks. A comprehensive stack and vent survey to identify all the minor potential emission points at the Y-12 Plant will be completed before June 15, 1992. In areas already identified during this effort, estimates have been generated based on inventory and use records using the procedure outlined in 40 CFR Part 61, Appendix D. Estimates for additional areas that will be identified by June 15, 1992, will be reported in the 1992 Annual Emissions Report. The Y-12 Plant source term also includes estimates for radionuclides emitted from the ORNL Biology, Fusion Energy, and Analytical Chemistry Laboratory research facilities located at the Y-12 Plant. These estimates were based on inventory and use records using the procedure outlined in 40 CFR Part 61, Appendix D.

SOURCE DESCRIPTION: ORNL

ORNL, located toward the west end of Bethel Valley, is a large, multipurpose research laboratory whose basic mission is to expand knowledge, both basic and applied, in areas related to energy. To accomplish this mission, ORNL conducts research in fields of modern science and technology. ORNL's facilities include nuclear reactors, chemical pilot plants, research laboratories, radioisotope production laboratories, accelerators, fusion test devices, and support facilities. In addition to the main ORNL complex, the ORNL Biology, Fusion Energy, and Engineering Technology divisions and staff from other ORNL divisions are located at the Y-12 Plant, and the Applied Technology Division is located at the K-25 Site.

The source term information from the ORNL site is obtained from four major sources and from a number of minor emission sources. Radionuclide emissions at ORNL vary because of the wide range of research activities performed. Sources of radionuclide emissions are mainly ventilation from (1) isotope production/handling areas, (2) reactor research, (3) analytical facilities, (4) small, bench-scale experiments, and (5) out-of-service and decommissioned facilities. Emissions typically consist of particulate, adsorbable gases, nonabsorbable gases (i.e., noble gases), and tritium.

Major sources at ORNL consist of four continuously sampled stacks. These stacks have the potential to emit radionuclides resulting in a dose greater than or equal to 0.1 mrem/year to the most exposed member of the public. Emissions from these stacks were quantified using continuous sampling and laboratory analysis. Each of these major source sampling systems is currently being upgraded in accordance with the ORR FFCA to ensure compliance with 40 CFR 61.93(b). The upgrades are scheduled for completion by October 15, 1992.

Minor sources at ORNL consist of 13 point sources and 2 different grouped sources. Minor sources emit radionuclides that result in a potential dose lower than 0.1 mrem/year to the most exposed member of the public. Several sources will be sampled for the first time in 1992; therefore, emission estimates for 1991 are not available. Emission estimates for these sources will be made in 1992 and reported in the 1992 Annual Emissions Report. Emissions for the two grouped minor sources are from laboratory hoods. Emissions from these grouped sources were estimated using radionuclide inventory data and emission factors provided in 40 CFR 61, Appendix D. Laboratory hood emissions typically result from bench-scale experiments and are exhausted through small stacks and vents.

SOURCE DESCRIPTION: K-25 SITE

The Oak Ridge K-25 Site, which is located on Highway 58 near the Clinch River and Poplar Creek, has several major responsibilities: (1) to provide waste handling and storage capabilities for other DOE facilities; (2) to provide applied technology support for a variety of customers, including DOE and other government agencies; (3) to provide support to DOE decontamination and decommissioning activities; and (4) to provide analytical laboratory support for environmental compliance to DOE facilities. Activities associated with these functions include the Toxic Substances Control Act (TSCA) Incinerator, waste storage and handling, research and development, and fabrication and machining of various components.

The source term information from the K-25 Site was obtained from the operation of one continuous stack sampling system located on the K-1435 TSCA Incinerator and from emissions estimated from grab samples collected at the K-1015 Laundry. In addition, an estimate of emissions was made from operations in the K-1420 disassembly area. The K-1435 TSCA Incinerator is the only source at the K-25 Site that was judged to have the potential to emit radionuclides that would result in an EDE greater than or equal to 0.1 mrem/year to the most affected off-site resident. The K-1015 Laundry stack was identified as a source for which grab sampling was an appropriate method for determining emissions.

The continuous sampling system design and operation used to determine emissions from the K-1435 TSCA Incinerator were reviewed by EPA Region IV and approved in October 1987. The design and operation of the grab sampling system used to estimate emissions from the K-1015 Laundry were in accordance with the ORR *Compliance Plan*; however, the sample point was located upstream of the abatement equipment. The emissions were then estimated using the data prior to the abatement and assuming the abatement efficiency to be zero.

While all major and some minor uranium emissions are evaluated using the methods described above, it is recognized that some unmonitored emissions occur. These emissions result mainly from room and air ventilation systems serving process and waste management areas and development and laboratory operations. Emission estimates for minor sources other than K-1015

and K-1420 have not been developed (i.e., laboratory hoods). Although it is believed that emissions from these areas are insignificant, those that exist within plant Radiological Areas will be evaluated as required by the ORR FFCA by September 1992. Emissions from this survey will be included in the 1992 Annual Emissions Report. A stack and vent survey was initiated in 1991 to identify all of these minor sources.

SECTION II. AIR EMISSIONS DATA FOR MAJOR SOURCES - Y-12 PLANT

Major Point Source ¹	Type of Control ²	Efficiency (%)	Distance to Receptor ³ (m)	Date of Initial Measurement for Monitored Stacks
Central Stack ⁴	N/A	N/A	770	Continuous
1	Precipitator, HEPA ⁵ Filter	50 99.97	790	Continuous
2	HEPA Filter	99.97	730	Continuous
3	Prefilter, HEPA Filter	60 99.97	800	Continuous
4	Bag House	95	790	Continuous
6	Cyclone, Filters, HEPA Filter	50 80 99.97	770	Continuous
7	HEPA Filter	99.97	770	Continuous
11	No Controls	N/A	835	Continuous
12	HEPA Filter	99.97	805	Continuous
13	Prefilters, Scrubber, HEPA Filter	60 90 99.97	880	Continuous
14	Rotoclone, HEPA Filter	50 99.97	800	Continuous
15	Prefilters, Demisters, HEPA Filter	60 70 99.97	830	Continuous
16	Dynel Roughing Filter	85	820	Continuous
17	HEPA Filter	99.97	885	Continuous
19	Scrubber, Bag House, HEPA Filter	90 95 99.97	580	Continuous
21	Filter, Sintered Metal, HEPA Filter	80 99 99.97	620	Continuous

SECTION II. AIR EMISSIONS DATA FOR MAJOR SOURCES - Y-12 PLANT

Major Point Source ¹	Type of Control ²	Efficiency (%)	Distance to Receptor ³ (m)	Date of Initial Measurement for Monitored Stacks
22	Condenser, Scrubber, Bag House	50 90 90	625	Continuous
24	HEPA Filter	99.97	630	Continuous
25	HEPA Filter	99.97	580	Continuous
26	HEPA Filter	99.97	550	Continuous
27	Roughing Filters, HEPA Filter	80 99.97	570	Continuous
28	Cyclones, Roughing Filters, HEPA Filter	50 80 99.97	570	Continuous
33	Cyclones, Bag House, HEPA Filter	50 90 99.97	600	Continuous
34	HEPA Filter	99.97	570	Continuous
36	HEPA Filter	99.97	570	Continuous
38	Filters, HEPA Filter	80 99.97	500	Continuous
40	Prefilter, HEPA Filter	80 99.97	620	Continuous
42	Demisters, Prefilter, Scrubber, HEPA Filter	70 80 90 99.97	590	Continuous
43	Roughing Filter, B-2000 Filter	80 90	500	Continuous
44	No Controls	N/A	555	Continuous
45	HEPA Filter	99.97	510	Continuous
47	No Controls	N/A	500	Continuous
48	Carbon Filter, HEPA Filter	80 99.97	500	Continuous
50	HEPA Filter	99.97	600	Continuous

SECTION II. AIR EMISSIONS DATA FOR MAJOR SOURCES - Y-12 PLANT

Major Point Source ¹	Type of Control ²	Efficiency (%)	Distance to Receptor ³ (m)	Date of Initial Measurement for Monitored Stacks
57	Metal Filter, Fabric Filter, HEPA Filter	50 90 99.97	650	Continuous
60	HEPA Filter	99.97	715	Continuous
61	HEPA Filter	99.97	720	Continuous
67	HEPA Filter	99.97	1220	Continuous
71	HEPA Filter	99.97	1120	Continuous
72	HEPA Filter	99.97	1130	Continuous
73	Bag House, HEPA Filter	90 99.97	1140	Continuous
75	HEPA Filter	99.97	1000	Continuous
76	HEPA Filter	99.97	1000	Continuous
83	Prefilters, HEPA Filter	60 99.97	1175	Continuous
85	B-2000 Filter, HEPA Filter	90 99.97	1460	Continuous
87	HEPA Filter	99.97	1465	Continuous
88	Rotoclone, Prefilter, Bag House, HEPA Filter	50 60 95 99.97	1455	Continuous
90	HEPA Filter	99.97	1460	Continuous
94	Cyclone, HEPA Filter	50 99.97	1455	Continuous
97	HEPA Filter	99.97	1425	Continuous
100	HEPA Filter	99.97	895	Continuous
101	HEPA Filter	99.97	900	Continuous
104	HEPA Filter	99.97	975	Continuous
105	HEPA Filter	99.97	980	Continuous
106	HEPA Filter	99.97	975	Continuous

SECTION II. AIR EMISSIONS DATA FOR MAJOR SOURCES - Y-12 PLANT

Major Point Source ¹	Type of Control ²	Efficiency (%)	Distance to Receptor ³ (m)	Date of Initial Measurement for Monitored Stacks
107	HEPA Filter	99.97	980	Continuous
109	Prefilter, HEPA Filter	60 99.97	1730	Continuous
110	Bag House, HEPA Filter	95 99.97	510	Continuous
111	Carbocell, Bronze Wool, Sintered Metal Filters	50 50 99	635	Continuous
112	Carbocell, Bronze Wool, Sintered Metal Filters	50 50 99	630	Continuous Impinger-type sampler ⁶
113	Scrubber, HEPA Filter	90 99.97	510	Continuous
114	HEPA Filter	99.97	500	Continuous
115	Carbocell, Bronze Wool, Sintered Metal Filters	50 50 99	860	Continuous Impinger-type sampler ⁶
116	HEPA Filter	99.97	870	Continuous
127	Prefilter, HEPA Filter	60 99.97	1590	Continuous
132	Demister, HEPA Filter	70 99.97	590	Continuous

¹The point source number corresponds to the stack radiological monitoring program (SRMP) number.

²Some control devices are final controls that serve all processes exhausted to the stack, while other control devices serve individual processes. Not all stacks have a final control device.

³Distance is expressed as actual distance from the source to the nearest residence, business, school, or farm.

SECTION II. AIR EMISSIONS DATA FOR MAJOR SOURCES - Y-12 PLANT

⁴Based on guidance from EPA Region IV (letter from Charles R. Phillips to B. J. Davis, dated January 25, 1985), all Y-12 Plant emissions are assumed to come from a single central stack for modeling purposes. A study has been conducted to show that this assumption results in an overestimate of the dose resulting from Y-12 Plant emissions. Distances used for modeling purposes are outlined in Section III.

⁵High-efficiency particulate air (HEPA) filter.

⁶Sampling systems will be upgraded to comply with 40 CFR 61.93(b) by December 15, 1992.

SECTION II. AIR EMISSIONS DATA FOR MINOR AND GROUPED SOURCES-Y-12 PLANT

Minor Point or Grouped Source	Type of Control ¹	Efficiency (%)	Distance to Receptor ² (m)	Date of Initial Measurement for Monitored Stacks ³
18 Remaining Monitored Stacks ⁴	Cyclones, Prefilters, Demisters, Roughing Filters, Dynel Roughing Filters, Micrometallic Filters, Scrubbers, Electrostatic Precipitators, Bag Houses, HEPA Filters	50 60 70 80 85 90 90 95 95 99.97	570 - 1500	Continuous
Room ventilation Building 9212 Exhaust fan 533	None	N/A	610	N/A
Room ventilation Building 9212 Exhaust fan 155	None	N/A	615	N/A
Room ventilation Building 9212 Exhaust fan 520	None	N/A	590	N/A
Room ventilation Building 9212 Exhaust fan 532	None	N/A	635	N/A
Room ventilation Building 9212 Exhaust fan 534	None	N/A	610	N/A
Room ventilation Building 9212 Exhaust fan 554	None	N/A	605	N/A

SECTION II. AIR EMISSIONS DATA FOR MINOR AND GROUPED SOURCES-Y-12 PLANT

Minor Point or Grouped Source	Type of Control ¹	Efficiency (%)	Distance to Receptor ² (m)	Date of Initial Measurement for Monitored Stacks ³
Enriched Uranium Room Ventilation (3 buildings, approx. 18 emission points)	None	N/A	570 - 880	N/A
Depleted Uranium Room Ventilation (3 buildings, approx. 4 emission points)	None	N/A	570 - 1500	N/A
ORNL Biology Division (1 building, approx. 25 emission points)	HEPA Filter	99.97	900	N/A
ORNL Fusion Energy Division (1 building, approx. 3 emission points)	HEPA Filter	99.97	1280	N/A
ORNL Analytical Chemistry Division (1 building, approx. 6 emission points)	None	N/A	1100	N/A
ORNL Chemical Technology Division (1 building, approx. 3 emission points)	HEPA Filter	99.97	1300	N/A

SECTION II. AIR EMISSIONS DATA FOR MINOR AND GROUPED SOURCES-Y-12 PLANT

Minor Point or Grouped Source	Type of Control ¹	Efficiency (%)	Distance to Receptor ² (m)	Date of Initial Measurement for Monitored Stacks ³
Unmonitored Process Stacks (10 Buildings, approx. 31 emission points) ⁵	None	N/A	570-1500	N/A
Unmonitored Laboratory Exhausts (5 buildings, approx. 31 emission points) ⁵	B-2000 Filter, Scrubber, HEPA Filter	90 90 99.97	570-1500	N/A
Unmonitored Laboratory Exhaust, Building 9995 Exhaust Fan ⁵	None	N/A	605	N/A

¹Some control devices are final controls that serve all processes exhausted to the stack, while other control devices serve individual processes. Not all stacks have a final control device.

²Distance is expressed as actual distance from the source to the nearest residence, business, school, or farm. Distances used for modeling purposes are outlined in Section III.

³This column is applicable only for emission points whose effluent is monitored or sampled to determine emissions. An "N/A" indicates that some other method (i.e., Appendix D of 40 CFR 61, engineering calculations) is used to estimate emissions.

⁴The remaining 18 monitored stacks contribute as a group approximately 3% of the plant dose. Some of these monitored stacks have no emission control. Other stacks have emission control ranging from cyclones to HEPA filtration. The different types of control devices that may be found on these stacks have been listed with their estimated control efficiency.

⁵An ongoing stack and vent survey identified these sources after dose modeling had been completed for the 1991 Annual Report. These sources will be included in the 1992 annual report source term. An approximation of the dose impact will be included in Table A-1 that will be submitted to EPA by June 15, 1992. Resulting dose from each grouped source will be less than 0.1 mrem/year.

SECTION II. AIR EMISSIONS DATA FOR MAJOR SOURCES - ORNL

Major Point Source	Type of Control ¹	Efficiency (%)	Distance to Receptor ² (m)	Date of Initial Measurement for Monitored Stacks
X-2026	HEPA Filters, Charcoal Filters	99.97 90 (note 3)	3930	Continuous
X-3020	HEPA Filters	99.97	4030	Continuous
X-3039	HEPA Filters, Venturi Scrubber	99.97 98	4060	Continuous
X-7911	HEPA Filters, Packed Bed Scrubber, Charcoal Beds	99.97 90(note 4) 99.999	3360	Continuous

¹In addition to HEPA filters at Stacks 3020, 3039, and 7911, prefilters are also located at some of the individual sources within buildings. Efficiencies range from 90 to 99.97%.

²Distance is expressed as actual distance from the source to the nearest residence, business, school, or farm. Distances used for modeling purposes are outlined in Section III.

³Efficiency is based on data from Table 1 in 40 CFR Part 61, Appendix D.

⁴This scrubber is rated 98% efficient for removal of particulates 1 μ m or greater in diameter.

SECTION II. AIR EMISSIONS DATA FOR MINOR AND GROUPED SOURCES - ORNL

Minor Point or Grouped Source	Type of Control	Efficiency (%)	Distance to Receptor ¹ (m)	Date of Initial Measurement for Monitored Stacks ²
X-3018	HEPA Filter	99.97	4030	Identified in 1992, will calculate emissions prior to Dec. 31, 1992
X-3074 (2 emission points)	HEPA Filter	99.97	3940	Identified in 1992, will calculate emissions prior to Dec. 31, 1992
X-3544	HEPA Filter	99.97	3720	July 10, 1991
X-5505 (4 emission points)	HEPA Filter	99.97	4300	N/A
X-7025	None	N/A	3480	Continuous (1991)
X-7512	HEPA Filter, Charcoal Filter	99.97 90	3600	Continuous (1991)
X-7830 (tanks)	HEPA Filter	99.97	2350	Continuous (1991)
X-7830 (vault)	HEPA Filter	99.97	2350	Identified in 1992, will calculate emissions prior to Dec. 31, 1992
X-7877	HEPA Filter	99.97	2350	January 1, 1992
X-7860 (3 emission points)	HEPA Filter	99.97	2350	Identified in 1992, will calculate emissions prior to Dec. 31, 1992
X-7852-1	HEPA Filter	99.97	2620	Identified in 1992, will calculate emissions prior to Dec. 31, 1992
X7852-2	HEPA Filter	99.97	2620	Identified in 1992, will calculate emissions prior to Dec. 31, 1992
X-Laboratory Hoods (approximately 80 emission points)	None ³ HEPA Filter, Roughing Filter	0 99.97 80	3310 - 4030	N/A

See next page for endnotes.

¹Distance is expressed as actual distance from the source to the nearest residence, business, school, or farm. Distances used for modeling purposes are outlined in Section III.

²This column is applicable only for emission points whose effluent is monitored or sampled to determine emissions. An "N/A" indicates that some other method (i.e., Appendix D of 40 CFR 61, engineering calculations) is used to estimate emissions.

³The laboratory hoods go through HEPA filters or roughing filters or vent directly to the atmosphere.

**SECTION II. AIR EMISSIONS DATA
FOR MAJOR, MINOR, AND GROUPED SOURCES - K-25 SITE¹**

Major Point Source	Type of Control	Efficiency (%)	Distance to Receptor² (m)	Date of Initial Measurement for Monitored Stacks³
K-1435 TSCA Incinerator	Quench Chamber, Venturi, Cross-Flow Packed Bed Ionizing Wet Scrubber	96 (total)	2300	Continuous

Minor Point or Grouped Source	Type of Control	Efficiency (%)	Distance to Receptor² (m)	Date of Initial Measurement for Monitored Stacks³
K-1420 (1 emission point)	HEPA Filter	99.97	2400	N/A
K-1015 (2 emission points)	Bag House	80(note 4)	1930	June 20, 1991
K-Lab hoods (approximately 350 emission points) ⁵	HEPA Filter to None	99.97 0	1810	N/A

¹In accordance with the ORR FFCA, a list of all minor and grouped sources will be submitted to EPA-IV by September 15, 1992.

²Distance is expressed as distance from the source to the nearest residence, business, school, or farm. Distances used for modeling purposes are outlined in Section III.

³This column is applicable only for emission points whose effluent is monitored or sampled to determine emissions. An "N/A" indicates that some other method (i.e., Appendix D of 40 CFR 61, engineering calculations) is used to estimate emissions.

⁴For purposes of estimating emissions, abatement efficiency was assumed to be 0%.

⁵Emission estimates for these and other minor sources will be developed by September 15, 1992, in accordance with the ORR FFCA.

OAK RIDGE RESERVATION 1991 RADIONUCLIDE EMISSIONS ¹	
Radionuclides	Annual Quantity (Ci)
H-3	1.6E+04
Be-7	6.7E-06
C-14	4.1E-04
Na-22	8.0E-09
P-32	1.7E-05
S-35	1.5E-05
Cr-51	1.0E-08
Fe-55	1.7E-08
Cr-51	1.0E-08
Fe-55	1.7E-08
Fe-59	1.7E-07
Co-57	3.9E-07
Co-58	1.7E-07
Co-60	2.9E-04
Ni-63	1.0E-05
Zn-65	1.7E-07
Cu-67	5.0E-05
Br-82	8.8E-04
Kr-83m	7.5E+01
Kr-85	4.8E+03
Kr-85m	1.8E+02
Kr-87	3.6E+02
Kr-88	5.1E+02
Kr-89	6.5E+02
Sr-85	1.7E-08
Sr-90	4.0E-05
Nb-95	1.5E-06

OAK RIDGE RESERVATION 1991 RADIONUCLIDE EMISSIONS ¹	
Radionuclides	Annual Quantity (Ci)
Tc-99	3.8E-02
Ru-106	1.0E-09
Ag-110	2.0E-08
I-125	1.5E-04
I-129	4.2E-06
I-131	4.6E-02
I-132	5.2E-05
I-133	6.2E-02
I-134	5.2E-05
I-135	3.3E-02
Xe-133	9.1E+02
Xe-133m	2.8E+01
Xe-135	2.9E+01
Xe-135m	1.6E+02
Xe-138	8.8E+02
Cs-134	7.9E-09
Cs-137	1.7E-03
Cs-138	2.9E-04
Ba-137m	1.9E-03
Pm-147	1.0E-03
Eu-152	5.6E-08
Eu-154	2.7E-06
Gd-153	6.8E-10
Ho-166	5.0E-04
W-188	2.0E-07
Re-188	2.0E-04
Os-191	4.0E+00

OAK RIDGE RESERVATION 1991 RADIONUCLIDE EMISSIONS ¹	
Radionuclides	Annual Quantity (Ci)
Ir-192	1.9E-09
Ir-194	1.0E-05
Au-194	3.4E-03
Hg-203	1.0E-06
Po-210	1.1E-08
Pb-212	2.4E-01
Ra-224	1.0E-08
Ra-226	5.7E-05
Th-228	2.7E-03
Th-229	6.0E-10
Th-230	8.3E-05
Th-232	2.7E-05
Th-234	4.6E-02
Pa-234m	1.7E-01
U-233	3.0E-09
U-234	9.7E-02
U-235	1.7E-03
U-236	2.2E-04
U-238	7.4E-03
Np-237	9.1E-04
Pu-238	1.2E-07
Pu-239	1.2E-04
Pu-241	1.1E-09
Pu-242	1.0E-04
Am-241	4.0E-06
Am-243	1.0E-09
Cm-244	5.1E-06

**OAK RIDGE RESERVATION 1991
RADIONUCLIDE EMISSIONS¹**

Radionuclides	Annual Quantity (Ci)
Bk-249	3.0E-05

New and Modified Sources

No new sources or modifications of existing sources were completed during 1991 at the ORR.

¹This table represents the total emissions (monitored and unmonitored) for the three major installations located on the ORR.

SECTION III. DOSE ASSESSMENTS

DESCRIPTION OF DOSE MODEL

The radiation dose calculations were performed using the CAP-88 package of computer codes. This package contains EPA's most recent version of the AIRDOS-EPA computer code, which implements a steady-state, Gaussian plume, atmospheric dispersion model to calculate environmental concentrations of released radionuclides. Regulatory Guide 1.109 foodchain models are used to calculate human exposures, both internal and external, due to radionuclides deposited in the environment. The human exposure values are then used by the EPA's latest version of the DARTAB computer code to calculate radiation doses to man from radionuclides released during the year. The dose calculations use dose conversion factors in the latest version of the RADRISK data file, which is provided by the EPA with the CAP-88 package.

SUMMARY OF INPUT PARAMETERS

Except for those given below, all important input parameter values used are the default values provided with the CAP-88 computer codes and data bases.

Meteorological data:

- (1) the 100-m station on tower MT2 for X-2026, X-3020, X-3039, X-7025, X-3018, X-5505, and X-Misc. at ORNL;
- (2) the 30-m station on tower MT4 for X-7512, X-7830, X-7877, and X-7911 at ORNL;
- (3) the 60-m station on tower MT6 for all Y-12 Plant emission points; and
- (4) the 60-m station on tower MT1 for all K-25 Site emission points.

Rainfall rate: 153 cm/year

Average air temperature: 14°C

Average mixing layer height: 1000 m

Fraction of foodstuffs based upon defaults for rural areas:

	<u>Local area</u>	<u>50-mile radius</u>	<u>Beyond 50 miles</u>
Vegetables and produce	0.700	0.300	0.000
Meat	0.442	0.558	0.000
Milk	0.399	0.601	0.000

SOURCE CHARACTERISTICS ¹

Source name	Type	Release height (m)	Inner diam. (m)	Gas exit velocity (m/s)	Gas exit temp. (°C)	Dist. (m) & direction to max. exp. individ.	
						For Plant	For ORR
All Y-12	Point	20	0	0	Ambient	1080 NNE	1080 NNE
X-2026	Point	22.9	1.1	11.4	Ambient	4970 SW	9300 NE
X-3018	Point	61.0	4.1	7.7	Ambient	4970 SW	9300 NE
X-3020	Point	61.0	1.5	9.7	Ambient	4970 SW	9300 NE
X-3039	Point	76.2	2.4	11.4	Ambient	4970 SW	9300 NE
X-5505	Point	11.0	0.3	3.9	Ambient	4970 SW	9300 NE
X-7025	Point	4.0	0.3	14.0	Ambient	6910 WSW	7550 NNE
X-7512	Point	30.5	0.9	7.3	Ambient	5160 WSW	9640 NNE
X-7911	Point	76.2	1.52	10.1	Ambient	5160 WSW	9640 NNE
X-7830	Point	4.6	0.2	7.1	Ambient	3860 WSW	10990 NNE
X-7877	Point	13.9	0.41	16.2	Ambient	3860 WSW	10990 NNE
X-Labs	Point	15.0	0	0	Ambient	4970 SW	9300 NNE
K-1435	Point	30.5	1.37	5.5	77.2	5180 WSW	13000 ENE
K-1420	Point	18.3	0.60	50.7	Ambient	4820 WSW	13250 ENE
K-1015	Point	3.7	0	0	Ambient	4020 W	14000 ENE

¹For modelled sources only.

DISTANCES (m) TO SELECTED RECEPTORS¹

Source name	Nearest residence	Nearest business	Nearest school	Dairy	Nearest Farms	
					Beef	Vegetable
All Y-12	770	1,130	3,250	12,500	6,800	8,000
X-2026	4,060	4,940	11,000	9,200	6,000	13,500
X-3018	4,060	4,940	11,000	9,200	6,000	13,500
X-3020	4,060	4,940	11,000	9,200	6,000	13,500
X-3039	4,060	4,940	11,000	9,200	6,000	13,500
X-5505	4,060	4,940	11,000	9,200	6,000	13,500
X-7025	3,500	6,390	12,000	11,000	4,700	11,300
X-7512	3,360	4,220	9,300	9,300	4,600	12,500
X-7911	3,360	4,220	9,300	9,300	4,600	12,500
X-7830	2,350	3,010	8,500	8,000	5,400	14,000
X-7877	2,350	3,010	8,500	8,000	5,400	14,000
X-Labs	4,060	4,940	11,000	9,200	6,000	13,500
K-1435	3,000	2,300	4,650	7,250	5,600	18,800
K-1420	2,650	2,400	4,300	7,300	5,600	19,000
K-1015	2,920	1,930	4,650	6,500	4,940	19,000

¹For modelled sources only.

SOLUBILITY CLASSES FOR RADIONUCLIDE EMISSIONS

Y-12 PLANT

Nuclide	AMAD ¹ (μm)	Curies for each Solubility Class ²			
		D	W	Y	All
U-234	1.0	1.15E-02	1.74E-02	2.42E-02	5.32E-02
U-235	1.0	3.57E-04	5.41E-04	7.58E-04	1.66E-03
U-236	1.0	4.80E-05	7.24E-05	9.88E-05	2.19E-04
U-238	1.0	6.66E-05	4.88E-06	7.28E-03	7.35E-03
Total		1.20E-02	1.80E-02	3.24E-02	6.24E-02

¹Activity median aerodynamic diameter (AMAD) is expressed in micrometers (μm).

²Solubility classes were determined on the basis of a process engineering study. The results of this study were submitted to EPA Region IV on December 30, 1991.

SOLUBILITY CLASSES FOR MONITORED RADIONUCLIDE EMISSIONS

K-25 SITE

Nuclide	Solubility class	AMAD ¹ (μm)	Total curies released			
			K-1435 ²	K-1420	K-1015 ²	Total
Co-57	Y	1.0	3.83E-07			3.83E-07
Nb-95	Y	1.0	1.46E-06			1.46E-06
Ba-137m	D	1.0	5.30E-04		4.73E-08	5.30E-04
Cs-137	D	1.0	5.30E-04		4.73E-08	5.30E-04
Np-237	W	1.0	7.99E-04		4.41E-07	7.99E-04
Pa-234m	Y	1.0	1.70E-01		8.43E-06	1.70E-01
Pu-238	Y	1.0			4.26E-08	4.26E-08
Pu-239	Y	1.0	5.37E-05		4.77E-08	5.37E-05
Tc-99	W	1.0	3.74E-02		1.37E-06	3.74E-02
Th-228	Y	0.3	2.66E-03		2.70E-08	2.66E-03
Th-230	Y	0.3	8.31E-05		6.02E-08	8.32E-05
Th-232	Y	0.3	1.50E-05		3.41E-09	1.50E-05
Th-234	Y	0.3	4.64E-02		1.87E-06	4.64E-02
U-234	Y	0.3	4.36E-02	1.78E-08	2.34E-07	4.36E-02
U-235	Y	1.0		6.49E-10		6.49E-10
U-236	Y	1.0		3.99E-11		3.99E-11
U-238	Y	0.3		3.26E-09		3.26E-09

¹Activity median aerodynamic diameter (AMAD) is expressed in micrometers (μm).

²All uranium activity, which includes uranium-234, -235, and -238, is taken to be uranium-234 for dose calculations. This is a conservative estimate.

**SOLUBILITY CLASSES FOR MONITORED
RADIONUCLIDE EMISSIONS¹**

ORNL

Nuclide	Solubility Class	AMAD ² (μ m)	Total Curies Released
H-3	* ³	NA ³	1.60E+04
Be-7	Y	1.0	6.68E-06
Co-60	Y	1.0	1.95E-04
Br-82	D	1.0	8.84E-04
Kr-83m	* ³	0.0	7.53E+01
Kr-85	* ³	0.0	4.80E+03
Kr-85m	* ³	0.0	1.78E+02
Kr-87	* ³	0.0	3.60E+02
Kr-88	* ³	0.0	5.09E+02
Kr-89	* ³	0.0	6.46E+02
Sr-90	D	1.0	3.37E-05
I-129	D	1.0	4.20E-06
I-131	D	1.0	4.62E-02
I-132	D	1.0	5.15E-05
I-133	D	1.0	6.16E-02
I-134	D	1.0	5.15E-05
I-135	D	1.0	3.30E-02
Xe-133	* ³	0.0	9.08E+02
Xe-133m	* ³	0.0	2.82E+01
Xe-135	* ³	0.0	2.92E+01
Xe-135m	* ³	0.0	1.60E+02
Xe-138	* ³	0.0	8.76E+02
Cs-137	D	1.0	7.17E-05
Cs-138	D	1.0	2.88E-04

SOLUBILITY CLASSES FOR MONITORED RADIONUCLIDE EMISSIONS¹

ORNL

Nuclide	Solubility Class	AMAD ² (μm)	Total Curies Released
Ba-137m	D	1.0	7.17E-05
Os-191	Y	1.0	3.98E+00
Au-194	E ⁴	0.0	3.36E-03
Pb-212	D	1.0	2.41E-01
Th-228	Y	1.0	4.19E-08
Th-230	Y	1.0	1.42E-08
Th-232	Y	1.0	1.14E-08
U-234(note 5)	Y	1.0	7.43E-08
Pu-238	Y	1.0	7.26E-08
Pu-239	Y	1.0	5.84E-03
Am-241	W	1.0	2.97E-04

¹Solubility classes and curies released are provided for monitored sources. Solubility classes for unmonitored sources are assumed to be those that would give the highest dose.

²Activity median aerodynamic diameter (AMAD) is expressed in micrometers (μm).

³In the CAP-88 computer code, gases are not assigned a solubility class and the AMAD is assumed to be zero (designated by "*" in computer code).

⁴Only external dose conversion factors available in the RADRISK data base (designated by "E" in computer code).

⁵All uranium activity, which includes uranium-234, -235, and -238 is taken to be uranium-234 for dose calculations. This is a conservative estimate.

ORR COMPLIANCE ASSESSMENT

Effective Dose Equivalent: 1.7 mrem

Location of maximally exposed individual: Approximately 1080 meters NNE of the Y-12 Plant

CERTIFICATION

I certify under penalty of law that I have personally examined and am familiar with the information submitted herein and, based on my inquiry of those individuals immediately responsible for obtaining the information, I believe that the submitted information is true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment. (See 19 U.S.C. 1001.)

R. J. Spence, DOE-OR
Contracting Officer's Representative
Y-12 Plant

Date

T. S. Tison, DOE-OR
Contracting Officer's Representative
K-25 Site

Date

R. O. Hultgren, DOE-OR
Contracting Officer's Representative
Oak Ridge National Laboratory

Date

T. M. Jelinek, DOE-OR
Contracting Officer's Representative
Oak Ridge Associated Universities

Date

SECTION IV. SUPPLEMENTAL INFORMATION

DIFFUSE AND FUGITIVE EMISSIONS

EPA and DOE have not defined methodology or requirements for the measurement and reporting of fugitive and diffuse emissions, nor does ORR currently have any available methods to selectively and accurately estimate emissions from specific fugitive sources. Table I lists possible sources of fugitive and diffuse emissions on the ORR. These sources represent the largest and most significant areas of potential diffuse and fugitive emissions currently identified on the ORR. However, this list is not intended to list all areas with potential emissions since most of the manufacturing and research areas on the ORR have handled radioactive materials in the past.

It is anticipated that emissions due to these potential sources of diffuse and fugitive emissions are insignificant as compared to releases from point sources. Ambient air monitoring has historically demonstrated that measured radionuclide concentrations and resulting dose are less than predicted by computer dispersion modeling and dose assessments for emissions associated with point sources. These data reaffirm the assumption that diffuse and fugitive emissions do not contribute significantly to off-site dose. As an example, the 1991 estimated dose from point sources was approximately 1.7 mrem/year. However, the estimated doses as calculated from measured airborne radioactivity concentrations at an ambient air monitoring station located near the Y-12 Plant and ORNL were approximately 0.23 and 0.065 mrem/year, respectively. Therefore, on the basis of calculated and measured airborne radioactivity concentrations, it can be concluded that dose to the public is not being underestimated even though specific emission data on fugitive and diffuse sources are not available.

TABLE I
POSSIBLE FUGITIVE AND DIFFUSE SOURCES ON THE ORR¹

Y-12 Plant:	Contaminated Metal Salvage Yard (south of Building 9114) Outdoor storage area (Building 9720-32) Outdoor storage (Building 9720-34) Tooling laydown area (west of Building 9204-4) Closure activities (Kerr Hollow Quarry, United Nuclear Corporation Site)
K-25 Site:	K-770 Scrap Yard K-901-A Disposal Area K-1070-B Old Classified Burial Ground K-1203 Sewage Sludge Drying Beds K-1407-B Holding Pond K-1407-C Retention Basin and Soil K-1413 Treatment Tank K-1417 Block Casting/Storage Area and Soil
ORNL:	Trenching/excavation work in Waste Area Groups (WAGs) Solid Waste Disposal Areas (SWSAs) 1-6 Surface impoundments/retention basins [3513, 3524, 7852A (old Hydrofracture Pond), 7835 (Sludge Basin), 7905, 7906, 7907, 7908, and White Oak Lake] Low-level liquid waste tanks and associated valve pits and piping.

¹This list identifies the largest areas on the ORR with the most significant potential for fugitive and diffuse emissions.

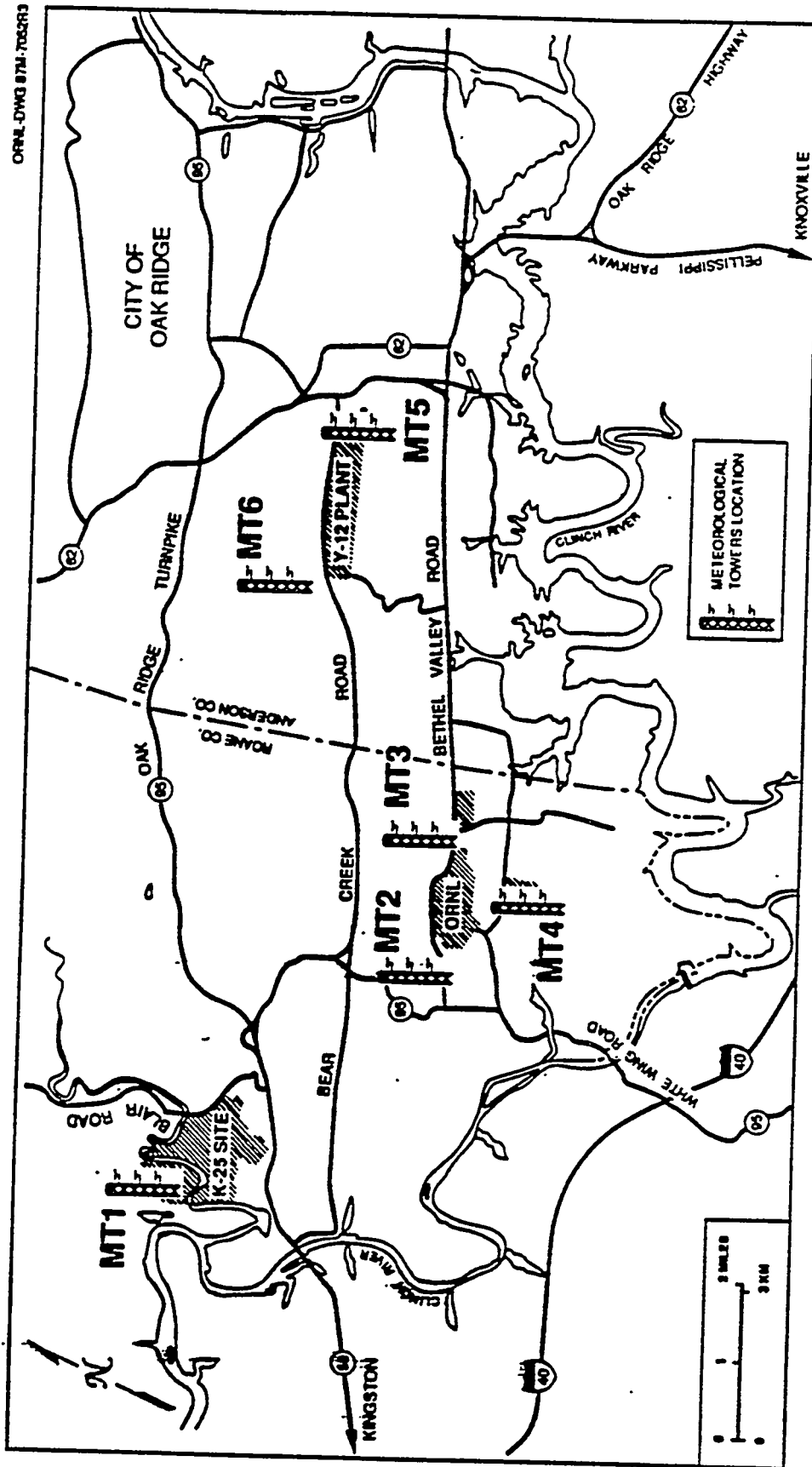


Fig 1. Map of ORR and locations of Meteorological Towers

Enclosure 2: ORR 1991 NESHAP Annual Air Emissions Report for Submittal to DOE-HQ

**U. S. Department of Energy
Air Emissions Annual Report (ES/ESH-24)
(under Subpart H, 40 CFR 61.94)
Calendar Year 1991**

Site Name: Oak Ridge Reservation

Field Office Information

Office: DOE OAK RIDGE FIELD OFFICE

Address: P.O. Box 2001

Oak Ridge, Tennessee 37831-8738

Contact: Peter J. Gross Phone: 615-576-0948

Site Information

Operating Contractor: Martin Marietta Energy Systems, Inc.

Address: P.O. Box 2003

Oak Ridge, Tennessee 37831-0738

Contact : Michael E. Mitchell Phone: 615-576-8006

SECTION I. FACILITY INFORMATION

SITE DESCRIPTION: ORR

The Oak Ridge Reservation (ORR) is located within the corporate limits of the city of Oak Ridge in eastern Tennessee. The ORR consists of approximately 14,300 ha (35,300 acres) of federally owned lands. The ORR site is predominantly to the west and south of the city of Oak Ridge, which has a population of 28,000. Oak Ridge lies in a valley between the Cumberland and southern Appalachian mountain ranges and is bordered on one side by the Clinch River. The Cumberlands are about 16 km (10 miles) northwest; 113 km (70 miles) to the southeast are the Great Smoky Mountains. A map of the ORR is found at the end of this report.

Except for the city of Oak Ridge, the land within 8 km (5 miles) of the ORR is predominantly rural, used largely for residences, small farms, and cattle pasture. Fishing, boating, water skiing, and swimming are favorite recreational activities in the area. The approximate location and population of the towns nearest the ORR are Oliver Springs (pop. 3600), 11 km (6.8 miles) to the northwest; Clinton (pop. 5200), 16 km (10 miles) to the northeast; Lenoir City (pop. 5400), 11 km (6.8 miles) to the southwest; and Harriman (pop. 8300), 13 km (8 miles) to the west. Knoxville, the major metropolitan area nearest Oak Ridge, is located about 40 km (25 miles) to the east and has a population of approximately 183,000.

Oak Ridge has a temperate climate with warm, humid summers and cool winters. Spring and fall are usually long, and the weather is normally sunny with mild temperatures. Severe storms such as tornadoes or high-velocity winds are rare. The mountains frequently divert hot, southeasterly winds that develop along the southern Atlantic coast. Oak Ridge is one of the country's calmest wind areas. The atmosphere can be considered to be in an inversion status about 36% of the time. The daily up-and-down valley winds, however, provide some diurnal exchange. The prevailing wind directions are northeasterly (up-valley) and southwesterly (down-valley).

The ORR contains three major operating facilities: Oak Ridge Y-12 Plant (Y-12 Plant), Oak Ridge National Laboratory (ORNL), and Oak Ridge K-25 Site (K-25 Site). In addition to operations at these three installations, DOE is responsible for facilities at the Oak Ridge Associated Universities (ORAU) that handle extremely small quantities of radionuclides for research and training purposes. Annual possession quantities for radionuclides handled at ORAU are well below the annual possession quantities for environmental compliance listed in 40 CFR 61, Appendix E, Table 1. Therefore, emission estimates from the ORAU operations are not included in this report.

The ORR and Environmental Protection Agency (EPA) Region IV have negotiated a Federal Facilities Compliance Agreement (FFCA), which will be used to bring the ORR into full compliance with 40 CFR 61, Subpart H. As required by the FFCA, the *Compliance Plan: National Emission Standards for Hazardous Air Pollutants for Airborne Radionuclides on the Oak Ridge Reservation, Oak Ridge, Tennessee*, was submitted to EPA Region IV on December 27, 1991. This compliance plan outlines in detail ORR's plan for complying with 40 CFR 61, Subpart H.

SOURCE DESCRIPTION: Y-12 PLANT

The Y-12 Plant is immediately adjacent to the city of Oak Ridge. Although the mission of the Y-12 Plant is currently in a state of flux, in 1991 the Y-12 Plant had five major responsibilities: (1) to fabricate nuclear weapons components; (2) to process source and special nuclear materials; (3) to provide support to the weapons design laboratories; (4) to provide support to other Martin Marietta Energy Systems, Inc., installations; and (5) to provide support to other government agencies. Activities associated with these functions include production of lithium compounds, recovery of enriched uranium from scrap material, and fabrication of uranium and other materials into finished parts and assemblies. Fabrication operations include vacuum casting, arc melting, powder compaction, rolling, forming, heat treating, machining, inspection, and testing. ORNL also operates research facilities at the Y-12 Plant. The ORNL facilities that emit radionuclides include the Biology Division laboratories, Fusion Energy Division facility, and Analytical Chemistry Division Laboratory.

Emissions of uranium from the Y-12 Plant occur as particulate emissions. Continuous sampling systems were used to monitor emissions from 81 process exhaust stacks. The sampling systems on all Y-12 stacks are similar in design to the stack samplers on the Uranium Chip Oxidization Facility, the Uranium Oxide Storage Vault, and the Enriched Uranium Conversion Facility. EPA Region IV reviewed the design and operation of the sampling systems on these three facilities as a part of the new source approval process. Approval to operate these facilities was received in April 1988. The stack sampling systems on the 81 monitored stacks were installed during an upgrade of the emissions monitoring system, which was completed in February 1987.

Of the 81 monitored stacks, 63 have been designated as major potential release points requiring continuous sampling under the NESHAP regulations. The source term information from the Y-12 Plant is obtained primarily from the operation of these continuous stack sampling systems located on enriched and depleted uranium exhaust stacks operated in 1991. The stacks that were continuously sampled included all but two of the process exhausts judged to have the potential to emit an environmentally significant quantity of uranium. The potential to emit was judged on the basis of a review of the operations and processes served by the exhaust systems to determine the quantity of uranium handled in the operation or process, the physical form of the uranium, and the nature of the operation or process. These factors determine the potential for uranium to become airborne in a manner that emissions to the environment might result. Sixty-three of the stacks which are currently equipped with continuous samplers have the potential to emit radionuclides that could cause a member of the public to receive an effective dose equivalent (EDE) equal to or greater than 0.1 mrem/year if no credit is taken for abatement equipment.

In addition to the 63 monitored stacks identified as major emission points, process stacks 112 and 115 are also major potential emission points. Both of these stacks are presently sampled by impinger-type samplers, which do not meet the requirements of 40 CFR 61.93(b). Continuous samplers were not installed when the other stacks were upgraded because of the corrosive conditions in the stacks. An action plan to upgrade both stacks has been developed and submitted to EPA as required under the FFCA. These two stack sampling systems will be upgraded by December 15, 1992.

The total of 65 major emission stacks in the 1991 annual report is significantly higher than the 18 identified in the 1990 annual report. The number of emission points subject to the requirements has increased over the past year for several reasons. First, increased conservatism in computer dose modeling (i.e., changes in solubility class assumptions) has resulted in a higher value of the dose-to-source term ratio. In addition, use of manufacturer's estimated abatement efficiencies instead of efficiencies provided in 40 CFR 61, Appendix D, have resulted in higher calculated potential doses.

While the majority of uranium emissions are monitored using the methods described above, it is recognized that some unmonitored emissions occur. These emissions result from room ventilation systems and unmonitored process stacks. The Y-12 Plant source term includes an estimate for both types of unmonitored emissions. The estimate of emissions from room ventilation systems is made using health physics data on airborne radioactivity concentrations in the work areas. Exhausts from any area where monthly concentration averages that exceeded 10% of the Derived Air Concentration (DAC) as defined in the *Compliance Plan* were included in the annual source term. The annual average concentrations were used with the design ventilation rates to arrive at the annual emission estimate for these areas. There were 24 ventilation systems from the enriched buildings and 4 ventilation systems from the depleted buildings that exceeded 10% of the DAC.

Additional unmonitored emissions occur from minor process stacks. A comprehensive stack and vent survey to identify all the minor potential emission points at the Y-12 Plant will be completed before June 15, 1992. In areas already identified during this effort, estimates have been generated based on inventory and use records using the procedure outlined in 40 CFR Part 61, Appendix D. Estimates for additional areas that will be identified by June 15, 1992, will be reported in the 1992 Annual Emissions Report. The Y-12 Plant source term also includes estimates for radionuclides emitted from the ORNL Biology, Fusion Energy, and Analytical Chemistry Laboratory research facilities located at the Y-12 Plant. These estimates were based on inventory and use records using the procedure outlined in 40 CFR Part 61, Appendix D.

SOURCE DESCRIPTION: ORNL

ORNL, located toward the west end of Bethel Valley, is a large, multipurpose research laboratory whose basic mission is to expand knowledge, both basic and applied, in areas related to energy. To accomplish this mission, ORNL conducts research in fields of modern science and technology. ORNL's facilities include nuclear reactors, chemical pilot plants, research laboratories, radioisotope production laboratories, accelerators, fusion test devices, and support facilities. In addition to the main ORNL complex, the ORNL Biology, Fusion Energy, and Engineering Technology divisions and staff from other ORNL divisions are located at the Y-12 Plant, and the Applied Technology Division is located at the K-25 Site.

The source term information from the ORNL site is obtained from four major sources and from a number of minor emission sources. Radionuclide emissions at ORNL vary because of the wide range of research activities performed. Sources of radionuclide emissions are mainly ventilation from (1) isotope production/handling areas, (2) reactor research, (3) analytical facilities, (4) small, bench-scale experiments, and (5) out-of-service and decommissioned facilities. Emissions typically consist of particulate, adsorbable gases, nonadsorbable gases (i.e., noble gases), and tritium.

Major sources at ORNL consist of four continuously sampled stacks. These stacks have the potential to emit radionuclides resulting in a dose greater than or equal to 0.1 mrem/year to the most exposed member of the public. Emissions from these stacks were quantified using continuous sampling and laboratory analysis. Each of these major source sampling systems is currently being upgraded in accordance with the ORR FFCA to ensure compliance with 40 CFR 61.93(b). The upgrades are scheduled for completion by October 15, 1992.

Minor sources at ORNL consist of 13 point sources and 2 different grouped sources. Minor sources emit radionuclides that result in a potential dose lower than 0.1 mrem/year to the most exposed member of the public. Several sources will be sampled for the first time in 1992; therefore, emission estimates for 1991 are not available. Emission estimates for these sources will be made in 1992 and reported in the 1992 Annual Emissions Report. Emissions for the two grouped minor sources are from laboratory hoods. Emissions from these grouped sources were estimated using radionuclide inventory data and emission factors provided in 40 CFR 61, Appendix D. Laboratory hood emissions typically result from bench-scale experiments and are exhausted through small stacks and vents.

SOURCE DESCRIPTION: K-25 SITE

The Oak Ridge K-25 Site, which is located on Highway 58 near the Clinch River and Poplar Creek, has several major responsibilities: (1) to provide waste handling and storage capabilities for other DOE facilities; (2) to provide applied technology support for a variety of customers, including DOE and other government agencies; (3) to provide support to DOE decontamination and decommissioning activities; and (4) to provide analytical laboratory support for environmental compliance to DOE facilities. Activities associated with these functions include the Toxic Substances Control Act (TSCA) Incinerator, waste storage and handling, research and development, and fabrication and machining of various components.

The source term information from the K-25 Site was obtained from the operation of one continuous stack sampling system located on the K-1435 TSCA Incinerator and from emissions estimated from grab samples collected at the K-1015 Laundry. In addition, an estimate of emissions was made from operations in the K-1420 disassembly area. The K-1435 TSCA Incinerator is the only source at the K-25 Site that was judged to have the potential to emit radionuclides that would result in an EDE greater than or equal to 0.1 mrem/year to the most affected off-site resident. The K-1015 Laundry stack was identified as a source for which grab sampling was an appropriate method for determining emissions.

The continuous sampling system design and operation used to determine emissions from the K-1435 TSCA Incinerator were reviewed by EPA Region IV and approved in October 1987. The design and operation of the grab sampling system used to estimate emissions from the K-1015 Laundry were in accordance with the ORR *Compliance Plan*; however, the sample point was located upstream of the abatement equipment. The emissions were then estimated using the data prior to the abatement and assuming the abatement efficiency to be zero.

While all major and some minor uranium emissions are evaluated using the methods described above, it is recognized that some unmonitored emissions occur. These emissions result mainly from room and air ventilation systems serving process and waste management areas and development and laboratory operations. Emission estimates for minor sources other than K-1015

and K-1420 have not been developed (i.e., laboratory hoods). Although it is believed that emissions from these areas are insignificant, those that exist within plant Radiological Areas will be evaluated as required by the ORR FFCA by September 1992. Emissions from this survey will be included in the 1992 Annual Emissions Report. A stack and vent survey was initiated in 1991 to identify all of these minor sources.

SECTION II. AIR EMISSIONS DATA FOR MAJOR SOURCES - Y-12 PLANT

Major Point Source ¹	Type of Control ²	Efficiency (%)	Distance to Receptor ³ (m)	Date of Initial Measurement for Monitored Stacks
Central Stack ⁴	N/A	N/A	770	Continuous
1	Precipitator, HEPA ⁵ Filter	50 99.97	790	Continuous
2	HEPA Filter	99.97	730	Continuous
3	Prefilter, HEPA Filter	60 99.97	800	Continuous
4	Bag House	95	790	Continuous
6	Cyclone, Filters, HEPA Filter	50 80 99.97	770	Continuous
7	HEPA Filter	99.97	770	Continuous
11	No Controls	N/A	835	Continuous
12	HEPA Filter	99.97	805	Continuous
13	Prefilters, Scrubber, HEPA Filter	60 90 99.97	880	Continuous
14	Rotoclone, HEPA Filter	50 99.97	800	Continuous
15	Prefilters, Demisters, HEPA Filter	60 70 99.97	830	Continuous
16	Dynel Roughing Filter	85	820	Continuous
17	HEPA Filter	99.97	885	Continuous
19	Scrubber, Bag House, HEPA Filter	90 95 99.97	580	Continuous
21	Filter, Sintered Metal, HEPA Filter	80 99 99.97	620	Continuous

SECTION II. AIR EMISSIONS DATA FOR MAJOR SOURCES - Y-12 PLANT

Major Point Source ¹	Type of Control ²	Efficiency (%)	Distance to Receptor ³ (m)	Date of Initial Measurement for Monitored Stacks
22	Condenser, Scrubber, Bag House	50 90 90	625	Continuous
24	HEPA Filter	99.97	630	Continuous
25	HEPA Filter	99.97	580	Continuous
26	HEPA Filter	99.97	550	Continuous
27	Roughing Filters, HEPA Filter	80 99.97	570	Continuous
28	Cyclones, Roughing Filters, HEPA Filter	50 80 99.97	570	Continuous
33	Cyclones, Bag House, HEPA Filter	50 90 99.97	600	Continuous
34	HEPA Filter	99.97	570	Continuous
36	HEPA Filter	99.97	570	Continuous
38	Filters, HEPA Filter	80 99.97	500	Continuous
40	Prefilter, HEPA Filter	80 99.97	620	Continuous
42	Demisters, Prefilter, Scrubber, HEPA Filter	70 80 90 99.97	590	Continuous
43	Roughing Filter, B-2000 Filter	80 90	500	Continuous
44	No Controls	N/A	555	Continuous
45	HEPA Filter	99.97	510	Continuous
47	No Controls	N/A	500	Continuous
48	Carbon Filter, HEPA Filter	80 99.97	500	Continuous
50	HEPA Filter	99.97	600	Continuous

SECTION II. AIR EMISSIONS DATA FOR MAJOR SOURCES - Y-12 PLANT

Major Point Source ¹	Type of Control ²	Efficiency (%)	Distance to Receptor ³ (m)	Date of Initial Measurement for Monitored Stacks
57	Metal Filter, Fabric Filter, HEPA Filter	50 90 99.97	650	Continuous
60	HEPA Filter	99.97	715	Continuous
61	HEPA Filter	99.97	720	Continuous
67	HEPA Filter	99.97	1220	Continuous
71	HEPA Filter	99.97	1120	Continuous
72	HEPA Filter	99.97	1130	Continuous
73	Bag House, HEPA Filter	90 99.97	1140	Continuous
75	HEPA Filter	99.97	1000	Continuous
76	HEPA Filter	99.97	1000	Continuous
83	Prefilters, HEPA Filter	60 99.97	1175	Continuous
85	B-2000 Filter, HEPA Filter	90 99.97	1460	Continuous
87	HEPA Filter	99.97	1465	Continuous
88	Rotoclone, Prefilter, Bag House, HEPA Filter	50 60 95 99.97	1455	Continuous
90	HEPA Filter	99.97	1460	Continuous
94	Cyclone, HEPA Filter	50 99.97	1455	Continuous
97	HEPA Filter	99.97	1425	Continuous
100	HEPA Filter	99.97	895	Continuous
101	HEPA Filter	99.97	900	Continuous
104	HEPA Filter	99.97	975	Continuous
105	HEPA Filter	99.97	980	Continuous
106	HEPA Filter	99.97	975	Continuous

SECTION II. AIR EMISSIONS DATA FOR MAJOR SOURCES - Y-12 PLANT

Major Point Source ¹	Type of Control ²	Efficiency (%)	Distance to Receptor ³ (m)	Date of Initial Measurement for Monitored Stacks
107	HEPA Filter	99.97	980	Continuous
109	Prefilter, HEPA Filter	60 99.97	1730	Continuous
110	Bag House, HEPA Filter	95 99.97	510	Continuous
111	Carbocell, Bronze Wool, Sintered Metal Filters	50 50 99	635	Continuous
112	Carbocell, Bronze Wool, Sintered Metal Filters	50 50 99	630	Continuous Impinger-type sampler ⁶
113	Scrubber, HEPA Filter	90 99.97	510	Continuous
114	HEPA Filter	99.97	500	Continuous
115	Carbocell, Bronze Wool, Sintered Metal Filters	50 50 99	860	Continuous Impinger-type sampler ⁶
116	HEPA Filter	99.97	870	Continuous
127	Prefilter, HEPA Filter	60 99.97	1590	Continuous
132	Demister, HEPA Filter	70 99.97	590	Continuous

¹The point source number corresponds to the stack radiological monitoring program (SRMP) number.

²Some control devices are final controls that serve all processes exhausted to the stack, while other control devices serve individual processes. Not all stacks have a final control device.

³Distance is expressed as actual distance from the source to the nearest residence, business, school, or farm.

SECTION II. AIR EMISSIONS DATA FOR MAJOR SOURCES - Y-12 PLANT

⁴Based on guidance from EPA Region IV (letter from Charles R. Phillips to B. J. Davis, dated January 25, 1985), all Y-12 Plant emissions are assumed to come from a single central stack for modeling purposes. A study has been conducted to show that this assumption results in an overestimate of the dose resulting from Y-12 Plant emissions. Distances used for modeling purposes are outlined in Section III.

⁵High-efficiency particulate air (HEPA) filter.

⁶Sampling systems will be upgraded to comply with 40 CFR 61.93(b) by December 15, 1992.

SECTION II. AIR EMISSIONS DATA FOR MINOR AND GROUPED SOURCES-Y-12 PLANT

Minor Point or Grouped Source	Type of Control ¹	Efficiency (%)	Distance to Receptor ² (m)	Date of Initial Measurement for Monitored Stacks ³
18 Remaining Monitored Stacks ⁴	Cyclones, Prefilters, Demisters, Roughing Filters, Dynel Roughing Filters, Micrometallic Filters, Scrubbers, Electrostatic Precipitators, Bag Houses, HEPA Filters	50 60 70 80 85 90 90 95 95 99.97	570 - 1500	Continuous
Room ventilation Building 9212 Exhaust fan 533	None	N/A	610	N/A
Room ventilation Building 9212 Exhaust fan 155	None	N/A	615	N/A
Room ventilation Building 9212 Exhaust fan 520	None	N/A	590	N/A
Room ventilation Building 9212 Exhaust fan 532	None	N/A	635	N/A
Room ventilation Building 9212 Exhaust fan 534	None	N/A	610	N/A
Room ventilation Building 9212 Exhaust fan 554	None	N/A	605	N/A

SECTION II. AIR EMISSIONS DATA FOR MINOR AND GROUPED SOURCES-Y-12 PLANT

Minor Point or Grouped Source	Type of Control ¹	Efficiency (%)	Distance to Receptor ² (m)	Date of Initial Measurement for Monitored Stacks ³
Enriched Uranium Room Ventilation (3 buildings, approx. 18 emission points)	None	N/A	570 - 880	N/A
Depleted Uranium Room Ventilation (3 buildings, approx. 4 emission points)	None	N/A	570 - 1500	N/A
ORNL Biology Division (1 building, approx. 25 emission points)	HEPA Filter	99.97	900	N/A
ORNL Fusion Energy Division (1 building, approx. 3 emission points)	HEPA Filter	99.97	1280	N/A
ORNL Analytical Chemistry Division (1 building, approx. 6 emission points)	None	N/A	1100	N/A
ORNL Chemical Technology Division (1 building, approx. 3 emission points)	HEPA Filter	99.97	1300	N/A

SECTION II. AIR EMISSIONS DATA FOR MINOR AND GROUPED SOURCES-Y-12 PLANT

Minor Point or Grouped Source	Type of Control ¹	Efficiency (%)	Distance to Receptor ² (m)	Date of Initial Measurement for Monitored Stacks ³
Unmonitored Process Stacks (10 Buildings, approx. 31 emission points) ⁵	None	N/A	570-1500	N/A
Unmonitored Laboratory Exhausts (5 buildings, approx. 31 emission points) ⁵	B-2000 Filter, Scrubber, HEPA Filter	90 90 99.97	570-1500	N/A
Unmonitored Laboratory Exhaust, Building 9995 Exhaust Fan 7 ⁵	None	N/A	605	N/A

¹Some control devices are final controls that serve all processes exhausted to the stack, while other control devices serve individual processes. Not all stacks have a final control device.

²Distance is expressed as actual distance from the source to the nearest residence, business, school, or farm. Distances used for modeling purposes are outlined in Section III.

³This column is applicable only for emission points whose effluent is monitored or sampled to determine emissions. An "N/A" indicates that some other method (i.e., Appendix D of 40 CFR 61, engineering calculations) is used to estimate emissions.

⁴The remaining 18 monitored stacks contribute as a group approximately 3% of the plant dose. Some of these monitored stacks have no emission control. Other stacks have emission control ranging from cyclones to HEPA filtration. The different types of control devices that may be found on these stacks have been listed with their estimated control efficiency.

⁵An ongoing stack and vent survey identified these sources after dose modeling had been completed for the 1991 Annual Report. These sources will be included in the 1992 annual report source term. An approximation of the dose impact will be included in Table A-1 that will be submitted to EPA by June 15, 1992. Resulting dose from each grouped source will be less than 0.1 mrem/year.

SECTION II. AIR EMISSIONS DATA FOR MAJOR SOURCES - ORNL

Major Point Source	Type of Control ¹	Efficiency (%)	Distance to Receptor ² (m)	Date of Initial Measurement for Monitored Stacks
X-2026	HEPA Filters, Charcoal Filters	99.97 90 (note 3)	3930	Continuous
X-3020	HEPA Filters	99.97	4030	Continuous
X-3039	HEPA Filters, Venturi Scrubber	99.97 98	4060	Continuous
X-7911	HEPA Filters, Packed Bed Scrubber, Charcoal Beds	99.97 90(note 4) 99.999	3360	Continuous

¹In addition to HEPA filters at Stacks 3020, 3039, and 7911, prefilters are also located at some of the individual sources within buildings. Efficiencies range from 90 to 99.97%.

²Distance is expressed as actual distance from the source to the nearest residence, business, school, or farm. Distances used for modeling purposes are outlined in Section III.

³Efficiency is based on data from Table 1 in 40 CFR Part 61, Appendix D.

⁴This scrubber is rated 98% efficient for removal of particulates 1 μm or greater in diameter.

SECTION II. AIR EMISSIONS DATA FOR MINOR AND GROUPED SOURCES - ORNL

Minor Point or Grouped Source	Type of Control	Efficiency (%)	Distance to Receptor ¹ (m)	Date of Initial Measurement for Monitored Stacks ²
X-3018	HEPA Filter	99.97	4030	Identified in 1992, will calculate emissions prior to Dec. 31, 1992
X-3074 (2 emission points)	HEPA Filter	99.97	3940	Identified in 1992, will calculate emissions prior to Dec. 31, 1992
X-3544	HEPA Filter	99.97	3720	July 10, 1991
X-5505 (4 emission points)	HEPA Filter	99.97	4300	N/A
X-7025	None	N/A	3480	Continuous (1991)
X-7512	HEPA Filter, Charcoal Filter	99.97 90	3600	Continuous (1991)
X-7830 (tanks)	HEPA Filter	99.97	2350	Continuous (1991)
X-7830 (vault)	HEPA Filter	99.97	2350	Identified in 1992, will calculate emissions prior to Dec. 31, 1992
X-7877	HEPA Filter	99.97	2350	January 1, 1992
X-7860 (3 emission points)	HEPA Filter	99.97	2350	Identified in 1992, will calculate emissions prior to Dec. 31, 1992
X-7852-1	HEPA Filter	99.97	2620	Identified in 1992, will calculate emissions prior to Dec. 31, 1992
X7852-2	HEPA Filter	99.97	2620	Identified in 1992, will calculate emissions prior to Dec. 31, 1992
X-Laboratory Hoods (approximately 80 emission points)	None ³ HEPA Filter, Roughing Filter	0 99.97 80	3310 - 4030	N/A

See next page for endnotes.

¹Distance is expressed as actual distance from the source to the nearest residence, business, school, or farm. Distances used for modeling purposes are outlined in Section III.

²This column is applicable only for emission points whose effluent is monitored or sampled to determine emissions. An "N/A" indicates that some other method (i.e., Appendix D of 40 CFR 61, engineering calculations) is used to estimate emissions.

³The laboratory hoods go through HEPA filters or roughing filters or vent directly to the atmosphere.

**SECTION II. AIR EMISSIONS DATA
FOR MAJOR, MINOR, AND GROUPED SOURCES - K-25 SITE¹**

Major Point Source	Type of Control	Efficiency (%)	Distance to Receptor² (m)	Date of Initial Measurement for Monitored Stacks³
K-1435 TSCA Incinerator	Quench Chamber, Venturi, Cross-Flow Packed Bed Ionizing Wet Scrubber	96 (total)	2300	Continuous

Minor Point or Grouped Source	Type of Control	Efficiency (%)	Distance to Receptor² (m)	Date of Initial Measurement for Monitored Stacks³
K-1420 (1 emission point)	HEPA Filter	99.97	2400	N/A
K-1015 (2 emission points)	Bag House	80(note 4)	1930	June 20, 1991
K-Lab hoods (approximately 350 emission points) ⁵	HEPA Filter to None	99.97 0	1810	N/A

¹In accordance with the ORR FFCA, a list of all minor and grouped sources will be submitted to EPA-IV by September 15, 1992.

²Distance is expressed as distance from the source to the nearest residence, business, school, or farm. Distances used for modeling purposes are outlined in Section III.

³This column is applicable only for emission points whose effluent is monitored or sampled to determine emissions. An "N/A" indicates that some other method (i.e., Appendix D of 40 CFR 61, engineering calculations) is used to estimate emissions.

⁴For purposes of estimating emissions, abatement efficiency was assumed to be 0%.

⁵Emission estimates for these and other minor sources will be developed by September 15, 1992, in accordance with the ORR FFCA.

OAK RIDGE RESERVATION 1991 RADIONUCLIDE EMISSIONS ¹	
Radionuclides	Annual Quantity (Ci)
H-3	1.6E+04
Be-7	6.7E-06
C-14	4.1E-04
Na-22	8.0E-09
P-32	1.7E-05
S-35	1.5E-05
Cr-51	1.0E-08
Fe-55	1.7E-08
Cr-51	1.0E-08
Fe-55	1.7E-08
Fe-59	1.7E-07
Co-57	3.9E-07
Co-58	1.7E-07
Co-60	2.9E-04
Ni-63	1.0E-05
Zn-65	1.7E-07
Cu-67	5.0E-05
Br-82	8.8E-04
Kr-83m	7.5E+01
Kr-85	4.8E+03
Kr-85m	1.8E+02
Kr-87	3.6E+02
Kr-88	5.1E+02
Kr-89	6.5E+02
Sr-85	1.7E-08
Sr-90	4.0E-05
Nb-95	1.5E-06

OAK RIDGE RESERVATION 1991 RADIONUCLIDE EMISSIONS ¹	
Radionuclides	Annual Quantity (Ci)
Tc-99	3.8E-02
Ru-106	1.0E-09
Ag-110	2.0E-08
I-125	1.5E-04
I-129	4.2E-06
I-131	4.6E-02
I-132	5.2E-05
I-133	6.2E-02
I-134	5.2E-05
I-135	3.3E-02
Xe-133	9.1E+02
Xe-133m	2.8E+01
Xe-135	2.9E+01
Xe-135m	1.6E+02
Xe-138	8.8E+02
Cs-134	7.9E-09
Cs-137	1.7E-03
Cs-138	2.9E-04
Ba-137m	1.9E-03
Pm-147	1.0E-03
Eu-152	5.6E-08
Eu-154	2.7E-06
Gd-153	6.8E-10
Ho-166	5.0E-04
W-188	2.0E-07
Re-188	2.0E-04
Os-191	4.0E+00

OAK RIDGE RESERVATION 1991 RADIONUCLIDE EMISSIONS ¹	
Radionuclides	Annual Quantity (Ci)
Ir-192	1.9E-09
Ir-194	1.0E-05
Au-194	3.4E-03
Hg-203	1.0E-06
Po-210	1.1E-08
Pb-212	2.4E-01
Ra-224	1.0E-08
Ra-226	5.7E-05
Th-228	2.7E-03
Th-229	6.0E-10
Th-230	8.3E-05
Th-232	2.7E-05
Th-234	4.6E-02
Pa-234m	1.7E-01
U-233	3.0E-09
U-234	9.7E-02
U-235	1.7E-03
U-236	2.2E-04
U-238	7.4E-03
Np-237	9.1E-04
Pu-238	1.2E-07
Pu-239	1.2E-04
Pu-241	1.1E-09
Pu-242	1.0E-04
Am-241	4.0E-06
Am-243	1.0E-09
Cm-244	5.1E-06

**OAK RIDGE RESERVATION 1991
RADIONUCLIDE EMISSIONS¹**

Radionuclides	Annual Quantity (Ci)
Bk-249	3.0E-05

New and Modified Sources

No new sources or modifications of existing sources were completed during 1991 at the ORR.

¹This table represents the total emissions (monitored and unmonitored) for the three major installations located on the ORR.

SECTION III. DOSE ASSESSMENTS

DESCRIPTION OF DOSE MODEL

The radiation dose calculations were performed using the CAP-88 package of computer codes. This package contains EPA's most recent version of the AIRDOS-EPA computer code, which implements a steady-state, Gaussian plume, atmospheric dispersion model to calculate environmental concentrations of released radionuclides. Regulatory Guide 1.109 foodchain models are used to calculate human exposures, both internal and external, due to radionuclides deposited in the environment. The human exposure values are then used by the EPA's latest version of the DARTAB computer code to calculate radiation doses to man from radionuclides released during the year. The dose calculations use dose conversion factors in the latest version of the RADRISK data file, which is provided by the EPA with the CAP-88 package.

SUMMARY OF INPUT PARAMETERS

Except for those given below, all important input parameter values used are the default values provided with the CAP-88 computer codes and data bases.

Meteorological data:

- (1) the 100-m station on tower MT2 for X-2026, X-3020, X-3039, X-7025, X-3018, X-5505, and X-Misc. at ORNL;
- (2) the 30-m station on tower MT4 for X-7512, X-7830, X-7877, and X-7911 at ORNL;
- (3) the 60-m station on tower MT6 for all Y-12 Plant emission points; and
- (4) the 60-m station on tower MT1 for all K-25 Site emission points.

Rainfall rate: 153 cm/year

Average air temperature: 14°C

Average mixing layer height: 1000 m

Fraction of foodstuffs based upon defaults for rural areas:

	<u>Local area</u>	<u>50-mile radius</u>	<u>Beyond 50 miles</u>
Vegetables and produce	0.700	0.300	0.000
Meat	0.442	0.558	0.000
Milk	0.399	0.601	0.000

SOURCE CHARACTERISTICS ¹

Source name	Type	Release height (m)	Inner diam. (m)	Gas exit velocity (m/s)	Gas exit temp. (°C)	Dist. (m) & direction to max. exp. individ.	
						For Plant	For ORR
All Y-12	Point	20	0	0	Ambient	1080 NNE	1080 NNE
X-2026	Point	22.9	1.1	11.4	Ambient	4970 SW	9300 NE
X-3018	Point	61.0	4.1	7.7	Ambient	4970 SW	9300 NE
X-3020	Point	61.0	1.5	9.7	Ambient	4970 SW	9300 NE
X-3039	Point	76.2	2.4	11.4	Ambient	4970 SW	9300 NE
X-5505	Point	11.0	0.3	3.9	Ambient	4970 SW	9300 NE
X-7025	Point	4.0	0.3	14.0	Ambient	6910 WSW	7550 NNE
X-7512	Point	30.5	0.9	7.3	Ambient	5160 WSW	9640 NNE
X-7911	Point	76.2	1.52	10.1	Ambient	5160 WSW	9640 NNE
X-7830	Point	4.6	0.2	7.1	Ambient	3860 WSW	10990 NNE
X-7877	Point	13.9	0.41	16.2	Ambient	3860 WSW	10990 NNE
X-Labs	Point	15.0	0	0	Ambient	4970 SW	9300 NNE
K-1435	Point	30.5	1.37	5.5	77.2	5180 WSW	13000 ENE
K-1420	Point	18.3	0.60	50.7	Ambient	4820 WSW	13250 ENE
K-1015	Point	3.7	0	0	Ambient	4020 W	14000 ENE

¹For modelled sources only.

DISTANCES (m) TO SELECTED RECEPTORS¹

Source name	Nearest residence	Nearest business	Nearest school	Dairy	Nearest Farms	
					Beef	Vegetable
All Y-12	770	1,130	3,250	12,500	6,800	8,000
X-2026	4,060	4,940	11,000	9,200	6,000	13,500
X-3018	4,060	4,940	11,000	9,200	6,000	13,500
X-3020	4,060	4,940	11,000	9,200	6,000	13,500
X-3039	4,060	4,940	11,000	9,200	6,000	13,500
X-5505	4,060	4,940	11,000	9,200	6,000	13,500
X-7025	3,500	6,390	12,000	11,000	4,700	11,300
X-7512	3,360	4,220	9,300	9,300	4,600	12,500
X-7911	3,360	4,220	9,300	9,300	4,600	12,500
X-7830	2,350	3,010	8,500	8,000	5,400	14,000
X-7877	2,350	3,010	8,500	8,000	5,400	14,000
X-Labs	4,060	4,940	11,000	9,200	6,000	13,500
K-1435	3,000	2,300	4,650	7,250	5,600	18,800
K-1420	2,650	2,400	4,300	7,300	5,600	19,000
K-1015	2,920	1,930	4,650	6,500	4,940	19,000

¹For modelled sources only.

SOLUBILITY CLASSES FOR RADIONUCLIDE EMISSIONS

Y-12 PLANT

Nuclide	AMAD ¹ (μm)	Curies for each Solubility Class ²			
		D	W	Y	All
U-234	1.0	1.15E-02	1.74E-02	2.42E-02	5.32E-02
U-235	1.0	3.57E-04	5.41E-04	7.58E-04	1.66E-03
U-236	1.0	4.80E-05	7.24E-05	9.88E-05	2.19E-04
U-238	1.0	6.66E-05	4.88E-06	7.28E-03	7.35E-03
Total		1.20E-02	1.80E-02	3.24E-02	6.24E-02

¹Activity median aerodynamic diameter (AMAD) is expressed in micrometers (μm).

²Solubility classes were determined on the basis of a process engineering study. The results of this study were submitted to EPA Region IV on December 30, 1991.

SOLUBILITY CLASSES FOR MONITORED RADIONUCLIDE EMISSIONS

K-25 SITE

Nuclide	Solubility class	AMAD ¹ (μm)	Total curies released			
			K-1435 ²	K-1420	K-1015 ²	Total
Co-57	Y	1.0	3.83E-07			3.83E-07
Nb-95	Y	1.0	1.46E-06			1.46E-06
Ba-137m	D	1.0	5.30E-04		4.73E-08	5.30E-04
Cs-137	D	1.0	5.30E-04		4.73E-08	5.30E-04
Np-237	W	1.0	7.99E-04		4.41E-07	7.99E-04
Pa-234m	Y	1.0	1.70E-01		8.43E-06	1.70E-01
Pu-238	Y	1.0			4.26E-08	4.26E-08
Pu-239	Y	1.0	5.37E-05		4.77E-08	5.37E-05
Tc-99	W	1.0	3.74E-02		1.37E-06	3.74E-02
Th-228	Y	0.3	2.66E-03		2.70E-08	2.66E-03
Th-230	Y	0.3	8.31E-05		6.02E-08	8.32E-05
Th-232	Y	0.3	1.50E-05		3.41E-09	1.50E-05
Th-234	Y	0.3	4.64E-02		1.87E-06	4.64E-02
U-234	Y	0.3	4.36E-02	1.78E-08	2.34E-07	4.36E-02
U-235	Y	1.0		6.49E-10		6.49E-10
U-236	Y	1.0		3.99E-11		3.99E-11
U-238	Y	0.3		3.26E-09		3.26E-09

¹Activity median aerodynamic diameter (AMAD) is expressed in micrometers (μm).

²All uranium activity, which includes uranium-234, -235, and -238, is taken to be uranium-234 for dose calculations. This is a conservative estimate.

**SOLUBILITY CLASSES FOR MONITORED
RADIONUCLIDE EMISSIONS¹**

ORNL

Nuclide	Solubility Class	AMAD ² (μm)	Total Curies Released
H-3	* ³	NA ³	1.60E+04
Be-7	Y	1.0	6.68E-06
Co-60	Y	1.0	1.95E-04
Br-82	D	1.0	8.84E-04
Kr-83m	* ³	0.0	7.53E+01
Kr-85	* ³	0.0	4.80E+03
Kr-85m	* ³	0.0	1.78E+02
Kr-87	* ³	0.0	3.60E+02
Kr-88	* ³	0.0	5.09E+02
Kr-89	* ³	0.0	6.46E+02
Sr-90	D	1.0	3.37E-05
I-129	D	1.0	4.20E-06
I-131	D	1.0	4.62E-02
I-132	D	1.0	5.15E-05
I-133	D	1.0	6.16E-02
I-134	D	1.0	5.15E-05
I-135	D	1.0	3.30E-02
Xe-133	* ³	0.0	9.08E+02
Xe-133m	* ³	0.0	2.82E+01
Xe-135	* ³	0.0	2.92E+01
Xe-135m	* ³	0.0	1.60E+02
Xe-138	* ³	0.0	8.76E+02
Cs-137	D	1.0	7.17E-05
Cs-138	D	1.0	2.88E-04

SOLUBILITY CLASSES FOR MONITORED RADIONUCLIDE EMISSIONS¹

ORNL

Nuclide	Solubility Class	AMAD ² (μ m)	Total Curies Released
Ba-137m	D	1.0	7.17E-05
Os-191	Y	1.0	3.98E+00
Au-194	E ⁴	0.0	3.36E-03
Pb-212	D	1.0	2.41E-01
Th-228	Y	1.0	4.19E-08
Th-230	Y	1.0	1.42E-08
Th-232	Y	1.0	1.14E-08
U-234(note 5)	Y	1.0	7.43E-08
Pu-238	Y	1.0	7.26E-08
Pu-239	Y	1.0	5.84E-03
Am-241	W	1.0	2.97E-04

¹Solubility classes and curies released are provided for monitored sources. Solubility classes for unmonitored sources are assumed to be those that would give the highest dose.

²Activity median aerodynamic diameter (AMAD) is expressed in micrometers (μ m).

³In the CAP-88 computer code, gases are not assigned a solubility class and the AMAD is assumed to be zero (designated by "***" in computer code).

⁴Only external dose conversion factors available in the RADRISK data base (designated by "E" in computer code).

⁵All uranium activity, which includes uranium-234, -235, and -238 is taken to be uranium-234 for dose calculations. This is a conservative estimate.

ORR COMPLIANCE ASSESSMENT

Effective Dose Equivalent: 1.7 mrem

Location of maximally exposed individual: Approximately 1080 meters NNE of the Y-12 Plant

CERTIFICATION

I certify under penalty of law that I have personally examined and am familiar with the information submitted herein and, based on my inquiry of those individuals immediately responsible for obtaining the information, I believe that the submitted information is true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment. (See 19 U.S.C. 1001.)

R. J. Spence, DOE-OR
Contracting Officer's Representative
Y-12 Plant

Date

T. S. Tison, DOE-OR
Contracting Officer's Representative
K-25 Site

Date

R. O. Hultgren, DOE-OR
Contracting Officer's Representative
Oak Ridge National Laboratory

Date

T. M. Jelinek, DOE-OR
Contracting Officer's Representative
Oak Ridge Associated Universities

Date

SECTION IV. SUPPLEMENTAL INFORMATION

DIFFUSE AND FUGITIVE EMISSIONS

EPA and DOE have not defined methodology or requirements for the measurement and reporting of fugitive and diffuse emissions, nor does ORR currently have any available methods to selectively and accurately estimate emissions from specific fugitive sources. Table I lists possible sources of fugitive and diffuse emissions on the ORR. These sources represent the largest and most significant areas of potential diffuse and fugitive emissions currently identified on the ORR. However, this list is not intended to list all areas with potential emissions since most of the manufacturing and research areas on the ORR have handled radioactive materials in the past.

It is anticipated that emissions due to these potential sources of diffuse and fugitive emissions are insignificant as compared to releases from point sources. Ambient air monitoring has historically demonstrated that measured radionuclide concentrations and resulting dose are less than predicted by computer dispersion modeling and dose assessments for emissions associated with point sources. These data reaffirm the assumption that diffuse and fugitive emissions do not contribute significantly to off-site dose. As an example, the 1991 estimated dose from point sources was approximately 1.7 mrem/year. However, the estimated doses as calculated from measured airborne radioactivity concentrations at an ambient air monitoring station located near the Y-12 Plant and ORNL were approximately 0.23 and 0.065 mrem/year, respectively. Therefore, on the basis of calculated and measured airborne radioactivity concentrations, it can be concluded that dose to the public is not being underestimated even though specific emission data on fugitive and diffuse sources are not available.

COLLECTIVE EDE (PERSON-REM/YEAR)—50-MILE RADIUS

<u>Installation</u>	<u>Person-rem</u>
Y-12	10
ORNL	7
K-25	<u>23</u>
ORR	39*

*Because of rounding errors, the sum of the installation's collective EDE does not total to the ORR collective EDE.

UNPLANNED RELEASES

See Tables II and III for a list of the unplanned releases at the Y-12 Plant and K-25 Site, respectively. ORNL did not have any unplanned releases during 1991.

TABLE I
POSSIBLE FUGITIVE AND DIFFUSE SOURCES ON THE ORR¹

Y-12 Plant:	Contaminated Metal Salvage Yard (south of Building 9114) Outdoor storage area (Building 9720-32) Outdoor storage (Building 9720-34) Tooling laydown area (west of Building 9204-4) Closure activities (Kerr Hollow Quarry, United Nuclear Corporation Site)
K-25 Site:	K-770 Scrap Yard K-901-A Disposal Area K-1070-B Old Classified Burial Ground K-1203 Sewage Sludge Drying Beds K-1407-B Holding Pond K-1407-C Retention Basin and Soil K-1413 Treatment Tank K-1417 Block Casting/Storage Area and Soil
ORNL:	Trenching/excavation work in Waste Area Groups (WAGs) Solid Waste Disposal Areas (SWSAs) 1-6 Surface impoundments/retention basins [3513, 3524, 7852A (old Hydrofracture Pond), 7835 (Sludge Basin), 7905, 7906, 7907, 7908, and White Oak Lake] Low-level liquid waste tanks and associated valve pits and piping.

¹This list identifies the largest areas on the ORR with the most significant potential for fugitive and diffuse emissions.

TABLE II
UNPLANNED RELEASES FOR THE Y-12 PLANT

STACK	DATE	DESCRIPTION¹	CORRECTIVE ACTION
11	01/07/91	Water in Fan Basin	Pumped Water From Basin
11	01/18/91	Water in Fan Basin	Pumped Water From Basin
42	01/25/91	Equipment Failure	Repaired System
15	03/20/91	Process Fluctuation	Checked/Cleaned System
27	03/21/91	Process Fluctuation	Checked System
47	04/08/91	Process Fluctuation	Checked System
44	05/06/91	Process Fluctuation	Checked System
36	05/10/91	Equipment Failure	Checked/Cleaned System
36	05/23/91	Equipment Failure	Checked/Cleaned System
42	06/03/91	Process Fluctuation	Checked System
42	07/09/91	Process Fluctuation	Checked System
42	07/26/91	Process Fluctuation	Checked System
27	08/13/91	Process Fluctuation	Checked System
42	10/23/91	Process Fluctuation	Checked System
42	12/02/91	Process Fluctuation	Checked System

¹The specific quantities released are minimal and classified. The data are on file at the Y-12 Plant. The dose from these individual small quantities is known to be insignificant based on annual emission quantities and resultant doses. The quantities released are in the annual emission totals.

TABLE III
UNPLANNED RELEASES FOR THE K-25 SITE

BUILDING	DATE	DESCRIPTION	CORRECTIVE ACTION
K-1435	12/20/91	Thermal Relief Valve (TRV) event due to power failure	The system operated as designed. No corrective actions were necessary. ¹

¹The estimated dose due to the TRV event was 1.4×10^{-5} mrem/year to the most affected individual.

ESTIMATED RELEASES FROM UNMONITORED SOURCES

The estimated contribution to the ORR's maximum exposed individual due to small, unmonitored sources was approximately 0.3 mrem/year. Because of the lack of standardized EPA methodologies for estimating emissions from minor unmonitored sources, significant conservatism is used to estimate these releases. As a result, the estimates generally overestimate actual emissions. The methods used by ORR to estimate minor sources are outlined in *Compliance Plan: National Emission Standards for Hazardous Air Pollutants for Airborne Radionuclides on the Oak Ridge Reservation, Oak Ridge, Tennessee*, which was submitted to EPA Region IV on December 27, 1991. In accordance with the FFCA, the specific methods used for each minor and/or grouped source will be provided to EPA Region IV by June 15, 1992, for the Y-12 Plant and ORNL and by September 15, 1992, for the K-25 Site.

COMPLIANCE WITH SUBPARTS Q AND T OF 40 CFR 61

Not applicable.

Rn-220, Rn-222 EMISSIONS

ORNL: The four major sources have trace amounts of thorium-232 in their effluent streams. The potential percent contribution to dose from thorium at these sources ranges from 0.0005% for Stack 7911 up to 1% for Stack 3020. Uranium-232 was not reported as an effluent constituent of any of the major stacks at ORNL. However, lead-212, a daughter product of radon-220 is a component of effluent streams because of historic fixed contamination in the facilities. The only facility with the potential to exceed 0.1 mrem/year for lead-212 emissions is Stack 7911. In the course of routine effluent sampling, radon-222 or any of the daughter products have not been observed.

Y-12: An analysis of the potential emissions of radon-220 from the Y-12 Plant has not been conducted. It is believed that these emissions will be low based on the radionuclide content of the material streams currently processed at Y-12. The radionuclide content of materials shipped to Y-12 for processing, as well as the material streams in process at any time, are measured and controlled by procedures. An analysis of data generated under these procedures will be required to make a more quantitative estimate of potential radon-220 emissions.

The potential for emissions of radon-222 from nondisposal, nonstorage operations at the Y-12 Plant is thought to be very low. Radium-226, the progenitor of radon-222, is removed from natural uranium at the mills. Therefore, radon-222 generation from the uranium streams processed at Y-12 should be minimal. Also, an Indoor Radon Study of DOE facilities conducted in 1990 included data from several uranium processing areas. These data indicated that radon-222 levels were not significantly elevated.

K-25: There are no known sources of radon-220 at the K-25 Site. Radon-222 is a daughter of uranium-234. Although trace quantities of uranium-234 are found throughout the K-25 Site, the long half-life and the small quantities present indicate that it is very unlikely that radon-222 is present in significant amounts.

STATUS OF COMPLIANCE WITH NESHAP MONITORING REQUIREMENTS OF SUBPART H

ORNL: Four emission points are subject to the continuous emission monitoring requirements of 40 CFR 61.93 (b). Each of these emission points is currently being upgraded to comply with the regulatory requirements. The estimated cost is as follows: Stacks 2026 and 3020, approximately \$1,000K total; Stack 3039, approximately \$250K; Stack 7911, approximately \$60K.

Y-12: Sixty-five emission points are subject to the continuous emission monitoring requirements of 40 CFR 61.93 (b). The number of emission points subject to the requirements has increased over the past year for several reasons. First, increased conservatism in computer dose modeling (i.e., changes in solubility class assumptions) has resulted in a higher value of the dose-to-source term ratio. In addition, use of manufacturer's estimated abatement efficiencies instead of efficiencies provided in 40 CFR 61, Appendix D, have resulted in higher calculated potential doses. Sixty-three of these sources generally comply with the requirements of 40 CFR 61.93 (b); however, variability in stack flow rates is currently being reviewed to determine whether continuous flow rate measurement devices are required or whether administrative controls and conservative emission estimating techniques will provide sufficient accuracy. Two additional sources are currently being upgraded to comply with 40 CFR 61.93(b). The upgrades will cost approximately \$600,000 and will be completed by December 15, 1992.

K-25: Only one source, the TSCA Incinerator, is subject to the continuous emission monitoring requirements of 40 CFR 61.93 (b). The sampling system was reviewed and approved by EPA Region IV in October 1987. Recent studies have identified a discrepancy between the percent isokinetic sampling rate as calculated manually to that calculated using the incinerator's automated computer system. A study is currently under way to determine whether any modifications to the sampling and/or computer system are needed.

MINOR SOURCES: The periodic confirmatory measurement plan for minor sources is outlined in detail in *Compliance Plan: National Emission Standards for Hazardous Air Pollutants for Airborne Radionuclides on the Oak Ridge Reservation, Oak Ridge, Tennessee*, which was submitted to EPA on December 27, 1991. In addition, the specific methods used for each minor and/or grouped source will be provided to EPA Region IV by June 15, 1992, for the Y-12 Plant and ORNL and by September 15, 1992, for the K-25 Site.

STATUS OF QUALITY ASSURANCE (QA) PLANS

Each of the major ORR installations has prepared a QA Plan in accordance with 40 CFR 61, Appendix B, Method 114. Informal comments have been received from EPA on the draft Y-12 Plant and ORNL QA Plans. Comments received were minimal. The final plans will be submitted to EPA by June 15, 1992, in accordance with the ORR FFCA. ORAU has obtained a waiver from EPA for developing a QA Plan since the quantities of radionuclides used are less than the quantities identified in 40 CFR 61, Appendix E.

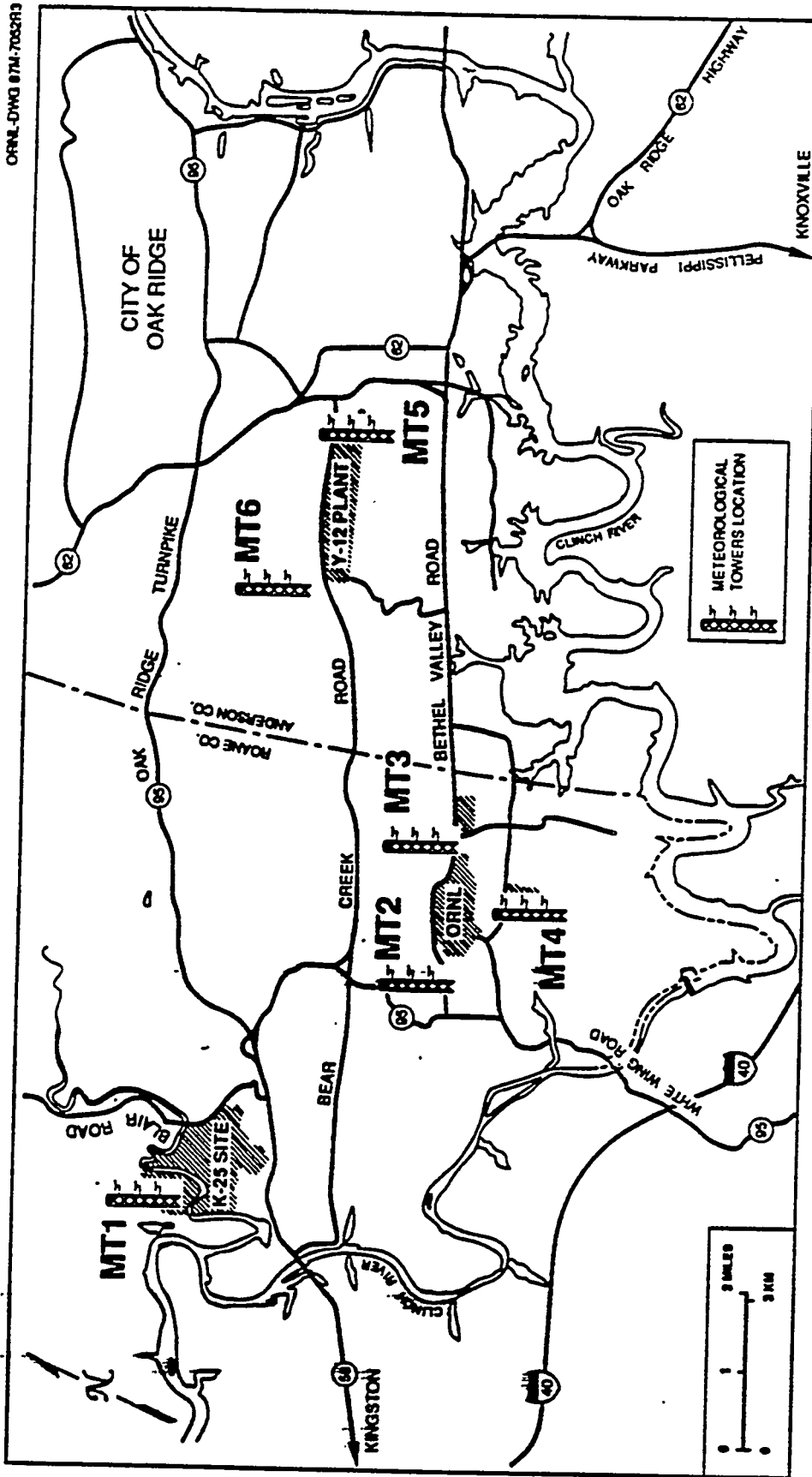


Fig 1. Map of ORR
and locations of
Meteorological Towers

ChemRisk Document Request Transmittal Form
(This section to be completed by ChemRisk)

S. Sandberg / ISD is requested to provide the following document

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Date of Request 12/10 Expected receipt of document 12/21

Title of requested document ORR Radionuclide National Emission
Standards for Hazardous Air Pollutants Annual Air Emissions
Report

Document Number MO0293

Access Number of Document ~~##~~ Date of Document 5/28/92

(This section to be completed by Derivative Classifier)

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Author(s) (indicate other divisions or organizations, if applicable) ME MITCHELL

Document type (See Doc. Prep. Guide, Chs. 1 and 2, for definitions of document types):

- ☐ Formal Report ☐ Progress Report ☐ Informal R&D Report ☐ Abstract ☐ Drawing
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